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ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE (STS-28) LAUNCH

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16. Abstract

This report presents a summary of selected atmospheric conditions observed near Space Shuttle STS-28 launch time on August 8, 1989, at Kennedy Space Center, Florida. STS-28 carried a Department of Defense payload and the flight azimuth ~~in this report will be~~ denoted by a reference flight azimuth, since the actual flight azimuth is not known. Values of ambient pressure, temperature, moisture, ground winds, visual observations (cloud), and winds aloft are included. The sequence of prelaunch Jimsphere-measured vertical wind profiles is given in this report. The final atmospheric tape, which consists of wind and thermodynamic parameters versus altitude, for STS-28 vehicle ascent has been constructed and represents the best estimate of the launch environment to 400,000 ft altitude that was traversed by the STS-28 vehicle. The STS-28 ascent atmospheric data tape has been constructed by Marshall Space Flight Center's Earth Science and Applications Division to provide an internally consistent data set for use in post-flight performance assessments.

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ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE (STS-28) LAUNCH

I. INTRODUCTION

This report presents an evaluation of the atmospheric environmental data taken during the launch of the Space Shuttle/STS-28 vehicle. This Space Shuttle vehicle was launched from Pad 39B at Kennedy Space Center (KSC), Florida, with a reference flight azimuth of 39-degrees east of north, at 1237 u.t. (0837 e.d.t.) on August 8, 1989.

This report presents a summary of the atmospheric environment at launch time (L+0) of the STS-28, together with the sequence of prelaunch Jimsphere-measured winds aloft profiles from L-5.37 hr through liftoff. The general atmospheric situation for the launch and flight area is described, and surface and upper level wind/thermodynamic observations near launch time are given. Since the ship Redstone was unavailable for STS-28 duty, the SRB descent/impact atmospheric data were not taken. However, one can use the STS-28 ascent data for SRB studies as the best substitute.

Previous MSFC-related launch vehicle atmospheric environmental conditions have been published as Appendix A of individual MSFC Saturn Flight Evaluation Working Group reports [1]. Office memorandums have been issued for previous flights giving launch pad wind information. A report has also been published [2] which summarizes most launch atmospheric conditions observed for the past 155 MSFC/ABMA-related vehicle launches through SA-208 (Skylab 4). Reports summarizing ASTP, STS-1 through STS-30 launch conditions are presented in References 3 through 25, respectively. Table 1 gives the atmospheric L+0 launch conditions for all the Space Shuttle missions.

II. SOURCES OF DATA

Atmospheric observational data used in this report were taken from synoptic maps made by the National Weather Service, plus all available surface observations and measurements from around the launch area. Upper air observations were taken from balloon-released instruments sent aloft from Cape Canaveral Air Force Station (CCAFS). High-altitude winds and thermodynamic data were not available from the Super-Loki rocketsondes launched from the CCAFS. The Global Reference Atmosphere Model (GRAM) [26] parameters for August KSC conditions were used to replace the Super-Loki rocketsonde data. Table 2 presents a listing of systems used to obtain the upper level wind profiles used in compiling the final ascent atmospheric data tape. Data cutoff altitudes are also given in Table 2.

III. GENERAL SYNOPTIC SITUATION AT LAUNCH TIME

A weak cold front was over northern Florida during the launch of STS-28. Surface winds were generally light and southwesterly over the KSC area. Figure 1 shows the surface map 37 min before launch of STS-28. Westerly winds dominated the flow aloft over the KSC region. Figure 2 presents the winds aloft condition at the 500-mb level 37 min before launch.

Skies were mostly clear over eastern Florida with the exception of fog and haze which was present prior to and during the launch of STS-28. Figure 3 depicts the GOES-7 infrared picture at 1241 u.t. (4 min after liftoff) with 500-mb heights denoted in meters and wind barbs superimposed. Figure 4 gives an up-close visible shot of the Florida peninsula as recorded by GOES-7 also taken at 1241 u.t. with temperatures, surface wind barbs, and pressure superimposed. The STS-28 Shuttle exhaust plume can also be seen in this figure.

IV. SURFACE OBSERVATIONS AT LAUNCH TIME

Surface observations at launch time for selected KSC locations are given in Table 3. Included are pad 39B, Shuttle runway, and CCAFS balloon release station observations. Neither precipitation nor lightning was observed at launch time.

Table 4 presents pad 39B wind data along with other standard hourly atmospheric measurements and sky observations for the 6-hr period prior to launch of STS-28. Values for wind speed and direction are given for the 18-m (60-ft) pad light pole level.

V. UPPER AIR MEASUREMENTS DURING LAUNCH

The FPS-16 Jimsphere (1252 u.t.) and the MSS Rawinsonde (1125 u.t.) systems were used to measure the upper level wind and thermodynamic parameters for STS-28 launch. At altitudes above the measured data, the GRAM [26] parameters for August KSC conditions were used. A tabulation of the STS-28 final atmospheric data for ascent is presented in Table 5 which lists the wind and thermodynamic parameters versus altitude. A brief summary of parameters is given in the following paragraphs.

A. Wind Speed

At launch time, wind speeds were 12.5 ft/s (7.4 kn) at 60 ft and increased to a maximum of 34.5 ft/s (20.4 kn) at 24,100 ft (7,346 m) and decreased above this level. Wind speeds increased steadily at the 56,000-ft (17,068-m) level giving a maximum of 83.0 ft/s (49.1 kn) at 89,500 ft (27,280 m) which was just below the altitude of the last measurable wind speed. The left side of Figure 5 shows a plot of the wind speed versus the altitude.

B. Wind Direction

At launch time, the 60-ft wind direction was from the west southwest and had a southwest to westerly component throughout the 49,800-ft (15,179-m) level. Above this level, winds became northerly and shifted gradually to southeasterly at around 55,000 ft (16,764 m). Winds took an easterly component above this altitude and continued easterly to the 92,000-ft (28,942-m) level which was the altitude of the last measurable wind.

C. Prelaunch/Launch Wind Profiles

Prelaunch/launch wind profiles given in Figures 6 through 9 were measured by the Jimsphere FPS-16 system. Data are shown for four measurement periods beginning at L–5.37 hr and extending through L + 15 min.

The wind speed and direction profiles for the 5.37-hr period prior to and including L + 15 min are shown in Figures 6 and 7. The in-plane (head-tail wind) and out-of-plane (left-right crosswind) profiles are given in Figures 8 and 9. The wind speeds and in-plane component speeds were less than the August mean wind values at mostly all altitude levels. The out-of-plane component speeds were less than the August 90-percentile wind values.

D. Thermodynamic Data

The thermodynamic data, taken at STS-28 launch time, consisted of atmospheric temperature, dew-point temperature, pressure, and density. These data have been compiled as the STS-28 ascent atmospheric data and are presented in Table 5. The vertical structure of temperature and dew-point temperature for STS-28 ascent are shown graphically versus altitude in Figure 10.

E. SRB Upper Air and Surface Measurements

As has been mentioned in the introduction, since there was no ship available, an SRB descent atmospheric data tape has not been constructed. The tabular values for the ascent atmospheric tape, as presented in Table 5, should be used for SRB descent/impact studies since it is the closest measured data source.

TABLE 1. SELECTED ATMOSPHERIC OBSERVATIONS FOR THE FLIGHTS OF THE SPACE SHUTTLE VEHICLES

Vehicle Data[h]				Surface Observations					Inflight Conditions Max. Wind Below 60,000 ft			
				Thermodynamic[a]			Wind[b]					
Seq. No.	Vehicle No.	Launch Date	Time (EST) Nearest Minute	Press.[c] N/cm^2	Temp. (°C)	Rel. Hum. (%)	Speed (ft/sec)	Dir. (deg)	Alt. (ft)	Speed (ft/sec)	Dir. (deg)	Count Down and Launch Comments of Meterological Significance
1	STS-1 Columbia	4/12/81	0700	10.234[d]	21	82	11.8 15.2	125 120	44,300	98	250	
2	STS-2 Columbia	11/12/81	1010	10.166	23	61	27.0 27.0	345 355	36,300	158	286	
3	STS-3 Columbia	3/22/82	1100	10.160	24	71	7.0[e] 8.0[e]	50[e] 145[e]	45,000	119	250	Wind directional change observed at Pad just prior to L+0. Onset of sea breeze.
4	STS-4 Columbia	6/27/82	1100[f]	10.200	29	70	5.8[g] 4.9[g]	133[g] 141[g]	47,900	37	329	
5	STS-5 Columbia	11/11/82	0719	10.227	22	68	22.0 35.0	90 90	40,600	146	336	
6	STS-6 Challenger	4/4/83	1330	10.183	23	55	12.7 16.4	63 55	46,100	155	277	
7	STS-7 Challenger	6/18/83	0733[f]	10.146	25	80	5.9[e] 10.3[e]	10[e] 350[e]	45,900	76	278	
8	STS-8 Challenger	8/30/83	0232[f]	10.111	24	97	8.8 14.0	269 268	45,100	30	349	17-min countdown delay due to adverse weather conditions.
9	STS-9 (SL-1) Columbia	11/28/83	1100	10.153	24	83	19.1 32.0	183 190	47,100	117	252	
10	STS-11 (41-B) Challenger	2/3/84	0800	10.173	17	75	0.0 NA	0 NA	38,200	143	288	
11	STS-13 (41-C) Challenger	4/6/84	0858	10.149	16	56	21.5 18.6	320 275	37,700	176	289	
12	STS-41D Discovery	8/30/84	0842[f]	10.172	26	81	3.0 3.6	106 39	40,300	44	270	
13	STS-41G Challenger	10/5/84	0703[f]	10.210	23	60	16.5 14.8	73 58	40,600	78	303	
14	STS-51A Discovery	11/8/84	0715	10.227	20	59	23.0 31.1	24 10	33,100	131	272	1-day delay due to excessive wind loads, calculated at high altitudes.
15	STS-51C Discovery	1/24/85	1450	10.173	18	46	17.1 15.5	228 253	42,900	199	265	1-day delay due to extreme cold surface temperatures.

TABLE 1. (Concluded)

Vehicle Data[h]				Surface Observations					Inflight Conditions Max. Wind Below 60,000 ft			
				Thermodynamic[a]			Wind[b]					
Seq. No.	Vehicle No.	Launch Date	Time (EST) Nearest Minute	Press.[c] N/cm^2	Temp. (°C)	Rel. Hum. (%)	Speed (ft/sec)	Dir. (deg)	Alt. (ft)	Speed (ft/sec)	Dir. (deg)	Count Down and Launch Comments of Meteorological Significance
16	STS-51D Discovery	4/12/85	1359	10.257	21	55	19.9 22.3	82 82	42,600	134	265	55-min delay due to a ship in the SRB impact area, and concerns over potential weather related impacts (cloud cover).
17	STS-51B Challenger	4/29/85	1202[f]	10.128	27	65	11.5 18.4	005 337	32,900 40,700	68 68	320 297	
18	STS-51G Discovery	6/17/85	0733[f]	10.201	23	91	2.9 11.8	201 206	40,100 46,700	55 55	298 302	
19	STS-51F Challenger	7/29/85	1700[f]	10.174	28	72	14.9 13.4	101 113	48,000	53	035	(20) 8/24 launch scrub due to unexceptable weather in launch area. Rain during countdown.
20	STS-51I Discovery	8/27/85	0658[f]	10.225	24	86	14.2 16.6	073 070	41,000	43	123	
21	STS-51J Atlantis	10/3/85	1115[f]	10.185	28	79	17.0 13.7	213 171	48,000	48	283	(24) 1/7 launch scrub due to unexceptable weather at TAL sites. 1/10 launch scrub due to heavy rain in launch area.
22	STS-61A Challenger	10/30/85	1200	10.059	28	72	12.7 14.1	217 174	43,000	81	218	
23	STS-61B Atlantis	11/26/85	1929	10.202	23	81	10.1 10.4	165 112	49,300	75	270	(25) 1/26 launch scrub due in part to potential bad weather associated with frontal passage. 1/27 launch scrub due in part to strong cross winds at X68. 1/28 2-hr delay due in part to cold early morning temps.
24	STS-61C Columbia	1/12/86	0655	10.206	12	84	15.4 18.6	323 342	40,000	221	263	
25[j]	STS-51L[i] Challenger	1/28/86	1138	10.253	3	27	20.1 15.3	331 262	42,000	174	264	
26[j]	STS-26 Discovery	9/29/88	1137[f]	10.182	29	56	13.7 13.5	058 047	53,100	44	304	(26) 1-hr and 37-min delay due to light winds.
27[j]	STS-27 Atlantis	12/2/88	930	10.270	14	50	25.5 22.0	314 352	40,200	187	245	(27) 1-day delay due to excessive wind loads, calculated at high altitudes.
28[j]	STS-29 Discovery	3/13/89	957	10.190	18	78	16.9	242	45,200	105	283	(28) 2-hr delay due to fog and strong winds aloft.
29[j]	STS-30 Atlantis	5/4/89	1437[f]	10.200	26	57	21.6	106	44,200	157	255	(29) 59-min delay due to cloud cover over the launch area.
30[j]	STS-28 Columbia	8/8/89	0837[f]	10.120	27	80	12.5	252	24,100	35	286	

a. Pad 39A thermodynamic measurements taken at approximately 1.2 m (4 ft) above natural grade at camera site No. 3.
b. 1-min average prior to L+0 of 60-ft PLP (listed first) and 275-ft FSS winds measured above natural grade. 275-ft FSS winds were not available after sequence No. 27.
c. Pressure measurement applicable to 21 ft above MSL unless otherwise indicated.
d. Pressure measurement applicable to 14 ft above MSL.
e. 10-sec average prior to L+0.
f. Eastern daylight time.
g. 30-sec average prior to L+0.
h. All vehicles launched from LC 39A except where noted.
i. Shuttle exploded in flight.
j. Vehicle launched from 39B.

TABLE 2. SYSTEMS USED TO MEASURE UPPER AIR WIND DATA FOR STS-28 ASCENT

	Date: August 8, 1989		Portion of Data Used			
	Release Time		Start		End	
Type of Data	Time (u.t.) (hr:min)	Time After L+0 (min)	Altitude m (ft)	Time After L+0 (min)	Altitude m (ft)	Time After L+0 (min)
FPS-16 Jimsphere	12:52	15	6 (21)	15	17,069 (56,000)	71
MSS Rawinsonde	11:25	-72	17,374 (57,000)	-15	28,042 (92,000)	20

TABLE 3. KSC SURFACE OBSERVATIONS AT STS-28 LAUNCH TIME

Location[a]	Time After L+0 (min)	Pressure (MSL) N/cm^2 (psia)	Temperature °K (°F)	Dew Point °K (°F)	Relative Humidity (%)	Visibility km (miles)	Sky Cover			Wind	
							Cloud Amount*	Cloud Type	Height of Base Meters (ft)	Speed ft/sec (kt)	Direction (deg)
NASA Space Shuttle Runway X68[e] Winds Measured at 10.4 m (34 ft)	0	10.119 (14.676)	300.9 (82.0)	295.9 (73.0)	74	8 (5)	1	Cirrus	9,144 (30,000)	10.1 (6.0))	270
CCAFS XMR[c] Surface Measurements	+1	10.122 (14.681)	300.9 (82.0)	298.1 (77.0)	85	8 (5)	1	Cirrus	9,144 (30,000)	8.4 (5.0)	250
Pad 39B[d] Lightpole SE 18.3 m (60.0 ft)[b]	0	10.120 (14.678)	299.8 (80.0)	295.9 (73.0)	80	-	-	-	-	12.5 (7.4)	252

*1/10 total sky cover at XMR and X68.

a. Altitudes of measurements are above natural grade, except where noted.

b. Approximately 5-min average prior to L+0.

c. Balloon release site.

d. Pad 39B thermodynamic measurements are taken at camera site No. 3, approximately 6.4 m (21 ft) above MSL.

e. Official STS-28 sky observational site.

TABLE 4. STS-28 PRE-LAUNCH THROUGH LAUNCH KSC PAD 39B ATMOSPHERIC MEASUREMENTS

Hourly Atmospheric Measurements[a]						Sky Condition[b]			
August 8, 1989 Time u.t.	Temperature (°F)	Dew Point (°F)	Relative Humidity (%)	60' Level (SE) WS Kt	60' Level (SE) WD°	Clouds	Total Sky Cover	Vis. (mi.)	Other Remarks
0700	79	72	80	6	248	Scattered at 27,000 ft	2/10	10	
0800	78	73	84	7	262	Scattered at 27,000 ft	3/10	10	
0900	77	73	86	6	196	Clear	0/10	7	
1000	76	72	88	6	238	Clear	0/10	7	
1100	76	73	89	6	263	Scattered at 30,000 ft	2/10	4	Vision obstructed by fog and haze.
1200	78	74	89	5	254	Scattered at 30,000 ft	1/10	4	Vision obstructed by fog and haze.
L+0[c] 1237	80	73	80	7	252	Scattered at 30,000 ft	1/10	5	Vision obstructed by haze.

a. Hourly pad observations (obtained via MSFC/HOSC) averaged over 5 min, centered on the hour.

b. Sky observations taken at the Shuttle runway site X68.

c. L+0 PAD wind and thermodynamic parameters obtained from HOSC strip charts. The SE anemometer was used at the 60-ft level for L+0 wind conditions (approximately 5-min average prior to L+0). Pad 39B L+0 atmospheric pressure at sea level was 10.120 N/cm^2.

TABLE 5. STS-28 ASCENT ATMOSPHERIC DATA TAPE

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
21.	10.17	270.00	24.71	0.1011E+04	0.1170E+04	23.41
100.	10.83	270.00	24.76	0.1008E+04	0.1166E+04	23.27
200.	11.48	270.00	24.82	0.1005E+04	0.1162E+04	23.10
300.	12.47	270.00	24.88	0.1001E+04	0.1158E+04	22.93
400.	13.12	271.00	24.94	0.9979E+03	0.1154E+04	22.75
500.	15.75	266.00	25.00	0.9944E+03	0.1150E+04	22.58
600.	15.42	268.00	25.06	0.9910E+03	0.1146E+04	22.40
700.	15.75	271.00	25.13	0.9876E+03	0.1142E+04	22.23
800.	16.73	275.00	25.19	0.9842E+03	0.1137E+04	22.06
900.	14.11	266.00	25.25	0.9808E+03	0.1133E+04	21.88
1000.	21.00	265.00	25.31	0.9774E+03	0.1129E+04	21.71
1100.	18.70	258.00	25.15	0.9740E+03	0.1126E+04	21.74
1200.	18.37	266.00	24.99	0.9707E+03	0.1123E+04	21.77
1300.	19.03	273.00	24.83	0.9673E+03	0.1119E+04	21.80
1400.	19.69	271.00	24.67	0.9640E+03	0.1116E+04	21.83
1500.	22.31	267.00	24.51	0.9607E+03	0.1113E+04	21.86
1600.	21.98	263.00	24.35	0.9573E+03	0.1109E+04	21.89
1700.	19.36	265.00	24.19	0.9540E+03	0.1106E+04	21.92
1800.	20.34	274.00	24.03	0.9507E+03	0.1103E+04	21.95
1900.	22.31	275.00	23.87	0.9475E+03	0.1100E+04	21.98
2000.	25.26	272.00	23.71	0.9442E+03	0.1096E+04	22.01
2100.	23.95	267.00	23.63	0.9409E+03	0.1093E+04	21.43
2200.	22.97	268.00	23.55	0.9377E+03	0.1090E+04	20.85
2300.	22.97	272.00	23.47	0.9344E+03	0.1087E+04	20.27
2400.	23.62	275.00	23.39	0.9312E+03	0.1084E+04	19.69
2500.	24.28	270.00	23.31	0.9280E+03	0.1081E+04	19.11
2600.	25.26	261.00	23.23	0.9247E+03	0.1077E+04	18.53
2700.	23.62	256.00	23.15	0.9215E+03	0.1074E+04	17.95
2800.	21.33	248.00	23.07	0.9184E+03	0.1071E+04	17.37
2900.	21.00	246.00	22.99	0.9152E+03	0.1068E+04	16.79
3000.	21.98	247.00	22.91	0.9120E+03	0.1065E+04	16.21
3100.	24.28	247.00	22.65	0.9088E+03	0.1062E+04	16.27
3200.	24.93	241.00	22.39	0.9056E+03	0.1059E+04	16.33
3300.	24.28	234.00	22.13	0.9025E+03	0.1056E+04	16.39
3400.	24.93	235.00	21.87	0.8993E+03	0.1054E+04	16.45
3500.	21.65	235.00	21.61	0.8962E+03	0.1051E+04	16.51
3600.	19.69	236.00	21.35	0.8930E+03	0.1048E+04	16.57
3700.	22.64	243.00	21.09	0.8899E+03	0.1045E+04	16.63
3800.	24.28	244.00	20.83	0.8868E+03	0.1042E+04	16.69
3900.	23.95	239.00	20.57	0.8837E+03	0.1040E+04	16.75
4000.	21.98	235.00	20.31	0.8806E+03	0.1037E+04	16.81
4100.	21.33	236.00	20.09	0.8775E+03	0.1034E+04	16.61
4200.	20.67	238.00	19.87	0.8744E+03	0.1031E+04	16.41
4300.	22.97	241.00	19.65	0.8713E+03	0.1028E+04	16.21
4400.	25.26	233.00	19.43	0.8683E+03	0.1026E+04	16.01
4500.	24.61	227.00	19.21	0.8652E+03	0.1023E+04	15.81
4600.	21.98	221.00	18.99	0.8622E+03	0.1020E+04	15.61
4700.	20.67	226.00	18.77	0.8591E+03	0.1017E+04	15.41
4800.	21.33	223.00	18.55	0.8561E+03	0.1015E+04	15.21
4900.	24.28	223.00	18.33	0.8531E+03	0.1012E+04	15.01

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
5000.	27.23	221.00	18.11	0.8501E+03	0.1009E+04	14.81
5100.	24.93	214.00	17.87	0.8471E+03	0.1006E+04	14.60
5200.	22.64	210.00	17.63	0.8441E+03	0.1004E+04	14.39
5300.	22.97	217.00	17.39	0.8411E+03	0.1001E+04	14.18
5400.	26.25	219.00	17.15	0.8381E+03	0.9985E+03	13.97
5500.	29.53	214.00	16.91	0.8352E+03	0.9959E+03	13.76
5600.	27.56	207.00	16.67	0.8322E+03	0.9933E+03	13.55
5700.	23.95	210.00	16.43	0.8293E+03	0.9906E+03	13.34
5800.	22.64	219.00	16.19	0.8263E+03	0.9880E+03	13.13
5900.	23.62	223.00	15.95	0.8234E+03	0.9854E+03	12.92
6000.	24.93	216.00	15.71	0.8205E+03	0.9828E+03	12.71
6100.	23.62	213.00	15.54	0.8176E+03	0.9799E+03	12.55
6200.	21.98	216.00	15.37	0.8146E+03	0.9770E+03	12.39
6300.	19.69	222.00	15.20	0.8117E+03	0.9742E+03	12.23
6400.	21.98	223.00	15.03	0.8088E+03	0.9713E+03	12.07
6500.	24.93	222.00	14.86	0.8059E+03	0.9684E+03	11.91
6600.	22.64	213.00	14.69	0.8030E+03	0.9656E+03	11.75
6700.	21.33	219.00	14.52	0.8002E+03	0.9627E+03	11.59
6800.	20.34	225.00	14.35	0.7973E+03	0.9599E+03	11.43
6900.	20.67	227.00	14.18	0.7944E+03	0.9571E+03	11.27
7000.	23.62	222.00	14.01	0.7916E+03	0.9542E+03	11.11
7100.	21.98	214.00	13.88	0.7888E+03	0.9514E+03	10.61
7200.	20.34	210.00	13.75	0.7859E+03	0.9486E+03	10.11
7300.	19.69	213.00	13.62	0.7831E+03	0.9458E+03	9.61
7400.	22.31	221.00	13.49	0.7803E+03	0.9430E+03	9.11
7500.	21.98	216.00	13.36	0.7775E+03	0.9402E+03	8.61
7600.	22.64	215.00	13.23	0.7747E+03	0.9374E+03	8.11
7700.	19.69	212.00	13.10	0.7719E+03	0.9346E+03	7.61
7800.	17.06	207.00	12.97	0.7691E+03	0.9318E+03	7.11
7900.	19.36	212.00	12.84	0.7664E+03	0.9290E+03	6.61
8000.	21.65	213.00	12.71	0.7636E+03	0.9262E+03	6.11
8100.	21.33	203.00	12.50	0.7608E+03	0.9235E+03	6.09
8200.	19.69	195.00	12.29	0.7581E+03	0.9208E+03	6.07
8300.	19.69	204.00	12.08	0.7553E+03	0.9182E+03	6.05
8400.	17.39	207.00	11.87	0.7526E+03	0.9155E+03	6.03
8500.	19.69	206.00	11.66	0.7498E+03	0.9128E+03	6.01
8600.	21.98	197.00	11.45	0.7471E+03	0.9102E+03	5.99
8700.	21.98	190.00	11.24	0.7444E+03	0.9075E+03	5.97
8800.	20.67	190.00	11.03	0.7417E+03	0.9049E+03	5.95
8900.	21.00	198.00	10.82	0.7390E+03	0.9022E+03	5.93
9000.	24.93	198.00	10.61	0.7363E+03	0.8996E+03	5.91
9100.	26.25	192.00	10.48	0.7336E+03	0.8970E+03	5.08
9200.	24.93	191.00	10.35	0.7309E+03	0.8943E+03	4.25
9300.	21.33	193.00	10.22	0.7283E+03	0.8917E+03	3.42
9400.	21.00	199.00	10.09	0.7256E+03	0.8890E+03	2.59
9500.	21.00	193.00	9.96	0.7230E+03	0.8864E+03	1.76
9600.	21.65	188.00	9.83	0.7203E+03	0.8837E+03	0.93
9700.	19.03	186.00	9.70	0.7177E+03	0.8811E+03	0.10
9800.	20.01	193.00	9.57	0.7151E+03	0.8784E+03	-0.73
9900.	22.64	189.00	9.44	0.7125E+03	0.8758E+03	-1.56

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
10000.	21.98	183.00	9.31	0.7099E+03	0.8731E+03	-2.39
10100.	18.04	188.00	9.21	0.7073E+03	0.8705E+03	-3.80
10200.	18.04	196.00	9.11	0.7047E+03	0.8678E+03	-5.21
10300.	21.98	198.00	9.01	0.7021E+03	0.8651E+03	-6.62
10400.	21.98	197.00	8.91	0.6995E+03	0.8624E+03	-8.03
10500.	19.03	198.00	8.81	0.6970E+03	0.8597E+03	-9.44
10600.	19.69	211.00	8.71	0.6944E+03	0.8570E+03	-10.85
10700.	20.01	209.00	8.61	0.6919E+03	0.8543E+03	-12.26
10800.	20.34	207.00	8.51	0.6893E+03	0.8516E+03	-13.67
10900.	19.03	216.00	8.41	0.6868E+03	0.8489E+03	-15.08
11000.	18.37	215.00	8.31	0.6843E+03	0.8462E+03	-16.49
11100.	21.98	204.00	8.12	0.6818E+03	0.8436E+03	-16.33
11200.	21.65	196.00	7.93	0.6793E+03	0.8411E+03	-16.17
11300.	20.67	199.00	7.74	0.6768E+03	0.8385E+03	-16.01
11400.	22.97	198.00	7.55	0.6743E+03	0.8360E+03	-15.85
11500.	25.59	190.00	7.36	0.6718E+03	0.8335E+03	-15.69
11600.	25.26	186.00	7.17	0.6693E+03	0.8309E+03	-15.53
11700.	24.28	189.00	6.98	0.6668E+03	0.8284E+03	-15.37
11800.	27.23	193.00	6.79	0.6644E+03	0.8259E+03	-15.21
11900.	28.87	194.00	6.60	0.6619E+03	0.8234E+03	-15.05
12000.	28.22	191.00	6.41	0.6595E+03	0.8209E+03	-14.89
12100.	28.87	196.00	6.21	0.6570E+03	0.8185E+03	-15.18
12200.	27.23	200.00	6.01	0.6546E+03	0.8160E+03	-15.47
12300.	28.87	193.00	5.81	0.6522E+03	0.8136E+03	-15.76
12400.	27.89	189.00	5.61	0.6498E+03	0.8112E+03	-16.05
12500.	26.25	197.00	5.41	0.6473E+03	0.8088E+03	-16.34
12600.	28.22	201.00	5.21	0.6449E+03	0.8063E+03	-16.63
12700.	27.89	198.00	5.01	0.6425E+03	0.8039E+03	-16.92
12800.	26.25	193.00	4.81	0.6401E+03	0.8015E+03	-17.21
12900.	25.26	199.00	4.61	0.6378E+03	0.7992E+03	-17.50
13000.	29.86	206.00	4.41	0.6354E+03	0.7968E+03	-17.79
13100.	33.46	203.00	4.26	0.6330E+03	0.7942E+03	-16.92
13200.	31.82	204.00	4.11	0.6306E+03	0.7916E+03	-16.05
13300.	28.22	206.00	3.96	0.6283E+03	0.7890E+03	-15.18
13400.	31.50	206.00	3.81	0.6259E+03	0.7864E+03	-14.31
13500.	29.86	202.00	3.66	0.6236E+03	0.7838E+03	-13.44
13600.	27.23	206.00	3.51	0.6213E+03	0.7812E+03	-12.57
13700.	29.53	216.00	3.36	0.6189E+03	0.7786E+03	-11.70
13800.	31.82	218.00	3.21	0.6166E+03	0.7760E+03	-10.83
13900.	27.89	216.00	3.06	0.6143E+03	0.7734E+03	-9.96
14000.	26.57	221.00	2.91	0.6120E+03	0.7708E+03	-9.09
14100.	27.89	229.00	2.79	0.6097E+03	0.7684E+03	-10.45
14200.	26.90	227.00	2.67	0.6074E+03	0.7660E+03	-11.81
14300.	21.98	228.00	2.55	0.6051E+03	0.7636E+03	-13.17
14400.	22.31	236.00	2.43	0.6029E+03	0.7611E+03	-14.53
14500.	22.31	236.00	2.31	0.6006E+03	0.7587E+03	-15.89
14600.	19.36	236.00	2.19	0.5983E+03	0.7563E+03	-17.25
14700.	18.04	246.00	2.07	0.5961E+03	0.7538E+03	-18.61
14800.	21.65	246.00	1.95	0.5939E+03	0.7514E+03	-19.97
14900.	20.01	241.00	1.83	0.5916E+03	0.7490E+03	-21.33

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
15000.	18.70	245.00	1.71	0.5894E+03	0.7466E+03	-22.69
15100.	19.69	253.00	1.54	0.5872E+03	0.7442E+03	-22.81
15200.	20.34	241.00	1.37	0.5850E+03	0.7418E+03	-22.93
15300.	17.06	244.00	1.20	0.5827E+03	0.7395E+03	-23.05
15400.	18.70	248.00	1.03	0.5805E+03	0.7372E+03	-23.17
15500.	15.42	244.00	0.86	0.5783E+03	0.7348E+03	-23.29
15600.	14.76	242.00	0.69	0.5762E+03	0.7325E+03	-23.41
15700.	17.39	235.00	0.52	0.5740E+03	0.7302E+03	-23.53
15800.	17.06	229.00	0.35	0.5718E+03	0.7279E+03	-23.65
15900.	19.69	231.00	0.18	0.5697E+03	0.7256E+03	-23.77
16000.	22.31	234.00	0.01	0.5675E+03	0.7233E+03	-23.89
16100.	19.69	231.00	-0.09	0.5653E+03	0.7208E+03	-24.00
16200.	21.33	243.00	-0.19	0.5632E+03	0.7184E+03	-24.11
16300.	21.98	249.00	-0.29	0.5611E+03	0.7159E+03	-24.22
16400.	21.65	257.00	-0.39	0.5589E+03	0.7134E+03	-24.33
16500.	24.93	262.00	-0.49	0.5568E+03	0.7110E+03	-24.44
16600.	21.65	262.00	-0.59	0.5547E+03	0.7086E+03	-24.55
16700.	21.33	263.00	-0.69	0.5526E+03	0.7061E+03	-24.66
16800.	19.36	254.00	-0.79	0.5505E+03	0.7037E+03	-24.77
16900.	18.37	252.00	-0.89	0.5484E+03	0.7013E+03	-24.88
17000.	18.70	246.00	-0.99	0.5463E+03	0.6989E+03	-24.99
17100.	15.42	253.00	-1.24	0.5442E+03	0.6969E+03	-25.14
17200.	16.40	255.00	-1.49	0.5421E+03	0.6948E+03	-25.29
17300.	15.75	245.00	-1.74	0.5401E+03	0.6928E+03	-25.44
17400.	18.70	255.00	-1.99	0.5380E+03	0.6908E+03	-25.59
17500.	19.36	252.00	-2.24	0.5360E+03	0.6888E+03	-25.74
17600.	16.40	259.00	-2.49	0.5339E+03	0.6868E+03	-25.89
17700.	16.73	257.00	-2.74	0.5319E+03	0.6848E+03	-26.04
17800.	15.42	266.00	-2.99	0.5298E+03	0.6829E+03	-26.19
17900.	18.70	258.00	-3.24	0.5278E+03	0.6809E+03	-26.34
18000.	15.75	250.00	-3.49	0.5258E+03	0.6789E+03	-26.49
18100.	21.00	257.00	-3.64	0.5238E+03	0.6767E+03	-26.64
18200.	19.36	252.00	-3.79	0.5218E+03	0.6745E+03	-26.79
18300.	20.67	260.00	-3.94	0.5197E+03	0.6722E+03	-26.94
18400.	22.64	261.00	-4.09	0.5177E+03	0.6700E+03	-27.09
18500.	20.01	265.00	-4.24	0.5158E+03	0.6678E+03	-27.24
18600.	21.65	266.00	-4.39	0.5138E+03	0.6656E+03	-27.39
18700.	20.01	263.00	-4.54	0.5118E+03	0.6634E+03	-27.54
18800.	18.70	270.00	-4.69	0.5098E+03	0.6613E+03	-27.69
18900.	20.01	269.00	-4.84	0.5079E+03	0.6591E+03	-27.84
19000.	17.39	262.00	-4.99	0.5059E+03	0.6569E+03	-27.99
19100.	19.36	268.00	-5.23	0.5039E+03	0.6550E+03	-27.73
19200.	20.01	263.00	-5.47	0.5020E+03	0.6530E+03	-27.47
19300.	18.04	264.00	-5.71	0.5001E+03	0.6511E+03	-27.21
19400.	18.70	268.00	-5.95	0.4981E+03	0.6491E+03	-26.95
19500.	18.37	262.00	-6.19	0.4962E+03	0.6472E+03	-26.69
19600.	17.72	270.00	-6.43	0.4943E+03	0.6453E+03	-26.43
19700.	22.61	269.00	-6.67	0.4924E+03	0.6433E+03	-26.17
19800.	22.64	271.00	-6.91	0.4905E+03	0.6414E+03	-25.91
19900.	24.61	271.00	-7.15	0.4886E+03	0.6395E+03	-25.65

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
20000.	25.92	265.00	-7.39	0.4867E+03	0.6376E+03	-25.39
20100.	25.26	262.00	-7.56	0.4848E+03	0.6355E+03	-25.71
20200.	26.25	264.00	-7.73	0.4829E+03	0.6335E+03	-26.03
20300.	25.92	258.00	-7.90	0.4810E+03	0.6314E+03	-26.35
20400.	24.61	262.00	-8.07	0.4791E+03	0.6293E+03	-26.67
20500.	27.23	261.00	-8.24	0.4773E+03	0.6273E+03	-26.99
20600.	25.92	255.00	-8.41	0.4754E+03	0.6252E+03	-27.31
20700.	26.90	259.00	-8.58	0.4735E+03	0.6232E+03	-27.63
20800.	26.57	250.00	-8.75	0.4717E+03	0.6212E+03	-27.95
20900.	25.92	250.00	-8.92	0.4698E+03	0.6192E+03	-28.27
21000.	26.57	254.00	-9.09	0.4680E+03	0.6171E+03	-28.59
21100.	26.90	249.00	-9.35	0.4662E+03	0.6153E+03	-28.34
21200.	24.61	251.00	-9.61	0.4643E+03	0.6135E+03	-28.09
21300.	26.57	253.00	-9.87	0.4625E+03	0.6117E+03	-27.84
21400.	23.62	249.00	-10.13	0.4607E+03	0.6098E+03	-27.59
21500.	22.97	257.00	-10.39	0.4589E+03	0.6080E+03	-27.34
21600.	24.28	253.00	-10.65	0.4571E+03	0.6062E+03	-27.09
21700.	23.62	253.00	-10.91	0.4553E+03	0.6044E+03	-26.84
21800.	25.59	255.00	-11.17	0.4535E+03	0.6026E+03	-26.59
21900.	26.25	250.00	-11.43	0.4517E+03	0.6009E+03	-26.34
22000.	25.26	248.00	-11.69	0.4499E+03	0.5991E+03	-26.09
22100.	28.54	256.00	-11.87	0.4481E+03	0.5971E+03	-26.67
22200.	29.20	252.00	-12.05	0.4463E+03	0.5952E+03	-27.25
22300.	27.23	256.00	-12.23	0.4446E+03	0.5933E+03	-27.83
22400.	27.89	257.00	-12.41	0.4428E+03	0.5913E+03	-28.41
22500.	27.89	252.00	-12.59	0.4411E+03	0.5894E+03	-28.99
22600.	28.22	255.00	-12.77	0.4393E+03	0.5875E+03	-29.57
22700.	29.20	258.00	-12.95	0.4376E+03	0.5856E+03	-30.15
22800.	27.89	253.00	-13.13	0.4358E+03	0.5837E+03	-30.73
22900.	29.86	262.00	-13.31	0.4341E+03	0.5818E+03	-31.31
23000.	31.17	262.00	-13.49	0.4324E+03	0.5799E+03	-31.89
23100.	28.54	267.00	-13.71	0.4307E+03	0.5781E+03	-32.06
23200.	30.84	270.00	-13.93	0.4289E+03	0.5763E+03	-32.23
23300.	28.87	270.00	-14.15	0.4272E+03	0.5744E+03	-32.40
23400.	28.22	268.00	-14.37	0.4255E+03	0.5726E+03	-32.57
23500.	31.50	275.00	-14.59	0.4238E+03	0.5708E+03	-32.74
23600.	33.14	274.00	-14.81	0.4221E+03	0.5690E+03	-32.91
23700.	31.82	277.00	-15.03	0.4204E+03	0.5672E+03	-33.08
23800.	30.84	284.00	-15.25	0.4187E+03	0.5654E+03	-33.25
23900.	32.81	279.00	-15.47	0.4171E+03	0.5637E+03	-33.42
24000.	32.48	285.00	-15.69	0.4154E+03	0.5619E+03	-33.59
24100.	34.45	286.00	-15.89	0.4137E+03	0.5600E+03	-33.23
24200.	32.15	279.00	-16.09	0.4120E+03	0.5582E+03	-32.87
24300.	31.50	284.00	-16.29	0.4104E+03	0.5564E+03	-32.51
24400.	29.53	278.00	-16.49	0.4087E+03	0.5546E+03	-32.15
24500.	26.25	279.00	-16.69	0.4071E+03	0.5527E+03	-31.79
24600.	25.26	282.00	-16.89	0.4054E+03	0.5509E+03	-31.43
24700.	22.97	279.00	-17.09	0.4038E+03	0.5491E+03	-31.07
24800.	23.62	276.00	-17.29	0.4021E+03	0.5473E+03	-30.71
24900.	24.28	268.00	-17.49	0.4005E+03	0.5455E+03	-30.35

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
25000.	22.64	266.00	-17.69	0.3989E+03	0.5437E+03	-29.99
25100.	21.98	263.00	-17.91	0.3973E+03	0.5420E+03	-30.04
25200.	19.69	255.00	-18.13	0.3957E+03	0.5402E+03	-30.09
25300.	20.01	254.00	-18.35	0.3941E+03	0.5385E+03	-30.14
25400.	18.37	254.00	-18.57	0.3925E+03	0.5368E+03	-30.19
25500.	19.36	269.00	-18.79	0.3909E+03	0.5351E+03	-30.24
25600.	20.01	266.00	-19.01	0.3893E+03	0.5334E+03	-30.29
25700.	18.70	272.00	-19.23	0.3877E+03	0.5317E+03	-30.34
25800.	21.00	273.00	-19.45	0.3861E+03	0.5300E+03	-30.39
25900.	20.34	271.00	-19.67	0.3846E+03	0.5283E+03	-30.44
26000.	21.33	278.00	-19.89	0.3830E+03	0.5266E+03	-30.49
26100.	23.62	280.00	-20.11	0.3814E+03	0.5249E+03	-30.94
26200.	20.34	278.00	-20.33	0.3799E+03	0.5232E+03	-31.39
26300.	21.33	284.00	-20.55	0.3783E+03	0.5215E+03	-31.84
26400.	21.98	276.00	-20.77	0.3768E+03	0.5198E+03	-32.29
26500.	20.01	271.00	-20.99	0.3752E+03	0.5182E+03	-32.74
26600.	20.34	279.00	-21.21	0.3737E+03	0.5165E+03	-33.19
26700.	20.34	272.00	-21.43	0.3722E+03	0.5149E+03	-33.64
26800.	20.67	274.00	-21.65	0.3706E+03	0.5132E+03	-34.09
26900.	23.29	278.00	-21.87	0.3691E+03	0.5116E+03	-34.54
27000.	24.93	278.00	-22.09	0.3676E+03	0.5099E+03	-34.99
27100.	21.98	274.00	-22.30	0.3661E+03	0.5082E+03	-34.87
27200.	24.28	277.00	-22.51	0.3646E+03	0.5065E+03	-34.75
27300.	25.26	278.00	-22.72	0.3630E+03	0.5048E+03	-34.63
27400.	22.31	274.00	-22.93	0.3615E+03	0.5032E+03	-34.51
27500.	22.97	274.00	-23.14	0.3600E+03	0.5015E+03	-34.39
27600.	20.67	270.00	-23.35	0.3585E+03	0.4998E+03	-34.27
27700.	19.03	268.00	-23.56	0.3570E+03	0.4982E+03	-34.15
27800.	19.36	278.00	-23.77	0.3556E+03	0.4965E+03	-34.03
27900.	21.65	268.00	-23.98	0.3541E+03	0.4949E+03	-33.91
28000.	21.33	267.00	-24.19	0.3526E+03	0.4932E+03	-33.79
28100.	20.67	277.00	-24.34	0.3511E+03	0.4915E+03	-34.32
28200.	18.37	270.00	-24.49	0.3497E+03	0.4897E+03	-34.85
28300.	15.75	271.00	-24.64	0.3482E+03	0.4880E+03	-35.38
28400.	18.70	271.00	-24.79	0.3468E+03	0.4863E+03	-35.91
28500.	16.73	266.00	-24.94	0.3453E+03	0.4845E+03	-36.44
28600.	16.40	272.00	-25.09	0.3439E+03	0.4828E+03	-36.97
28700.	18.04	272.00	-25.24	0.3425E+03	0.4811E+03	-37.50
28800.	17.06	265.00	-25.39	0.3410E+03	0.4794E+03	-38.03
28900.	17.72	277.00	-25.54	0.3396E+03	0.4777E+03	-38.56
29000.	18.37	267.00	-25.69	0.3382E+03	0.4760E+03	-39.09
29100.	17.72	275.00	-25.94	0.3368E+03	0.4745E+03	-38.88
29200.	19.69	275.00	-26.19	0.3354E+03	0.4730E+03	-38.67
29300.	16.73	275.00	-26.44	0.3340E+03	0.4715E+03	-38.46
29400.	18.70	274.00	-26.69	0.3326E+03	0.4700E+03	-38.25
29500.	16.40	274.00	-26.94	0.3312E+03	0.4685E+03	-38.04
29600.	17.39	278.00	-27.19	0.3298E+03	0.4670E+03	-37.83
29700.	17.39	274.00	-27.44	0.3284E+03	0.4655E+03	-37.62
29800.	17.06	276.00	-27.69	0.3270E+03	0.4640E+03	-37.41
29900.	17.72	262.00	-27.94	0.3257E+03	0.4625E+03	-37.20

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
30000.	16.73	269.00	-28.19	0.3243E+03	0.4611E+03	-36.99
30100.	18.37	261.00	-28.42	0.3229E+03	0.4595E+03	-37.24
30200.	17.39	259.00	-28.65	0.3216E+03	0.4580E+03	-37.49
30300.	20.01	262.00	-28.88	0.3202E+03	0.4565E+03	-37.74
30400.	20.34	261.00	-29.11	0.3188E+03	0.4550E+03	-37.99
30500.	21.65	256.00	-29.34	0.3175E+03	0.4535E+03	-38.24
30600.	19.36	253.00	-29.57	0.3161E+03	0.4520E+03	-38.49
30700.	20.67	258.00	-29.80	0.3148E+03	0.4505E+03	-38.74
30800.	20.34	252.00	-30.03	0.3135E+03	0.4490E+03	-38.99
30900.	20.01	263.00	-30.26	0.3121E+03	0.4476E+03	-39.24
31000.	19.36	260.00	-30.49	0.3108E+03	0.4461E+03	-39.49
31100.	21.33	261.00	-30.73	0.3095E+03	0.4446E+03	-39.51
31200.	18.37	262.00	-30.97	0.3081E+03	0.4431E+03	-39.53
31300.	21.65	259.00	-31.21	0.3068E+03	0.4417E+03	-39.55
31400.	19.69	258.00	-31.45	0.3055E+03	0.4402E+03	-39.57
31500.	21.33	254.00	-31.69	0.3042E+03	0.4388E+03	-39.59
31600.	20.01	250.00	-31.93	0.3029E+03	0.4373E+03	-39.61
31700.	20.34	247.00	-32.17	0.3016E+03	0.4359E+03	-39.63
31800.	18.04	248.00	-32.41	0.3003E+03	0.4344E+03	-39.65
31900.	18.04	246.00	-32.65	0.2990E+03	0.4330E+03	-39.67
32000.	17.72	249.00	-32.89	0.2977E+03	0.4315E+03	-39.69
32100.	18.04	252.00	-33.08	0.2964E+03	0.4300E+03	-39.94
32200.	19.36	246.00	-33.27	0.2951E+03	0.4285E+03	-40.19
32300.	22.31	253.00	-33.46	0.2939E+03	0.4270E+03	-40.44
32400.	20.01	262.00	-33.65	0.2926E+03	0.4255E+03	-40.69
32500.	21.98	264.00	-33.84	0.2913E+03	0.4240E+03	-40.94
32600.	20.67	263.00	-34.03	0.2901E+03	0.4225E+03	-41.19
32700.	19.69	267.00	-34.22	0.2888E+03	0.4210E+03	-41.44
32800.	20.34	263.00	-34.41	0.2876E+03	0.4195E+03	-41.69
32900.	18.70	269.00	-34.60	0.2863E+03	0.4181E+03	-41.94
33000.	21.65	270.00	-34.79	0.2851E+03	0.4166E+03	-42.19
33100.	20.01	272.00	-35.08	0.2839E+03	0.4153E+03	-42.46
33200.	21.98	271.00	-35.37	0.2826E+03	0.4140E+03	-42.73
33300.	19.69	267.00	-35.66	0.2814E+03	0.4127E+03	-43.00
33400.	18.70	274.00	-35.95	0.2802E+03	0.4114E+03	-43.27
33500.	19.69	265.00	-36.24	0.2789E+03	0.4101E+03	-43.54
33600.	17.72	273.00	-36.53	0.2777E+03	0.4088E+03	-43.81
33700.	18.04	268.00	-36.82	0.2765E+03	0.4075E+03	-44.08
33800.	15.75	268.00	-37.11	0.2753E+03	0.4062E+03	-44.35
33900.	16.40	273.00	-37.40	0.2741E+03	0.4050E+03	-44.62
34000.	15.42	260.00	-37.69	0.2729E+03	0.4037E+03	-44.89
34100.	12.47	269.00	-37.88	0.2717E+03	0.4022E+03	-45.23
34200.	13.78	266.00	-38.07	0.2705E+03	0.4008E+03	-45.57
34300.	12.47	261.00	-38.26	0.2693E+03	0.3994E+03	-45.91
34400.	10.50	264.00	-38.45	0.2681E+03	0.3979E+03	-46.25
34500.	9.19	242.00	-38.64	0.2669E+03	0.3965E+03	-46.59
34600.	5.58	250.00	-38.83	0.2658E+03	0.3951E+03	-46.93
34700.	6.89	232.00	-39.02	0.2646E+03	0.3936E+03	-47.27
34800.	7.22	237.00	-39.21	0.2634E+03	0.3922E+03	-47.61
34900.	10.83	240.00	-39.40	0.2623E+03	0.3908E+03	-47.95

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
35000.	12.47	242.00	-39.59	0.2611E+03	0.3894E+03	-48.29
35100.	10.17	256.00	-39.83	0.2599E+03	0.3881E+03	-48.83
35200.	12.80	249.00	-40.07	0.2588E+03	0.3868E+03	-49.37
35300.	12.14	239.00	-40.31	0.2577E+03	0.3855E+03	-49.91
35400.	12.80	242.00	-40.55	0.2565E+03	0.3842E+03	-50.45
35500.	12.47	234.00	-40.79	0.2554E+03	0.3829E+03	-50.99
35600.	10.17	253.00	-41.03	0.2543E+03	0.3816E+03	-51.53
35700.	9.51	249.00	-41.27	0.2531E+03	0.3803E+03	-52.07
35800.	9.84	231.00	-41.51	0.2520E+03	0.3790E+03	-52.61
35900.	9.51	236.00	-41.75	0.2509E+03	0.3777E+03	-53.15
36000.	10.50	221.00	-41.99	0.2498E+03	0.3764E+03	-53.69
36100.	8.53	228.00	-42.23	0.2487E+03	0.3751E+03	-53.83
36200.	7.55	230.00	-42.47	0.2476E+03	0.3738E+03	-53.97
36300.	7.55	222.00	-42.71	0.2464E+03	0.3725E+03	-54.11
36400.	10.17	227.00	-42.95	0.2453E+03	0.3713E+03	-54.25
36500.	10.50	220.00	-43.19	0.2442E+03	0.3700E+03	-54.39
36600.	7.55	230.00	-43.43	0.2431E+03	0.3687E+03	-54.53
36700.	9.19	228.00	-43.67	0.2420E+03	0.3674E+03	-54.67
36800.	6.56	219.00	-43.91	0.2410E+03	0.3662E+03	-54.81
36900.	8.53	229.00	-44.15	0.2399E+03	0.3649E+03	-54.95
37000.	9.84	219.00	-44.39	0.2388E+03	0.3636E+03	-55.09
37100.	8.53	228.00	-44.61	0.2377E+03	0.3623E+03	-55.31
37200.	9.84	230.00	-44.83	0.2366E+03	0.3610E+03	-55.53
37300.	10.50	220.00	-45.05	0.2355E+03	0.3597E+03	-55.75
37400.	11.81	229.00	-45.27	0.2345E+03	0.3584E+03	-55.97
37500.	12.80	214.00	-45.49	0.2334E+03	0.3571E+03	-56.19
37600.	9.84	228.00	-45.71	0.2323E+03	0.3558E+03	-56.41
37700.	10.83	217.00	-45.93	0.2313E+03	0.3545E+03	-56.63
37800.	9.51	230.00	-46.15	0.2302E+03	0.3533E+03	-56.85
37900.	11.81	231.00	-46.37	0.2291E+03	0.3520E+03	-57.07
38000.	12.47	220.00	-46.59	0.2281E+03	0.3507E+03	-57.29
38100.	10.83	236.00	-46.88	0.2271E+03	0.3496E+03	-57.56
38200.	12.80	223.00	-47.17	0.2260E+03	0.3484E+03	-57.83
38300.	12.80	225.00	-47.46	0.2250E+03	0.3473E+03	-58.10
38400.	14.44	234.00	-47.75	0.2240E+03	0.3461E+03	-58.37
38500.	15.09	228.00	-48.04	0.2229E+03	0.3450E+03	-58.64
38600.	17.39	235.00	-48.33	0.2219E+03	0.3439E+03	-58.91
38700.	14.44	234.00	-48.62	0.2209E+03	0.3427E+03	-59.18
38800.	13.12	242.00	-48.91	0.2199E+03	0.3416E+03	-59.45
38900.	13.12	237.00	-49.20	0.2189E+03	0.3405E+03	-59.72
39000.	10.50	234.00	-49.49	0.2179E+03	0.3394E+03	-59.99
39100.	14.44	232.00	-49.74	0.2169E+03	0.3382E+03	-60.18
39200.	10.83	225.00	-49.99	0.2159E+03	0.3370E+03	-60.37
39300.	12.47	230.00	-50.24	0.2149E+03	0.3358E+03	-60.56
39400.	15.09	212.00	-50.49	0.2139E+03	0.3346E+03	-60.75
39500.	10.17	226.00	-50.74	0.2129E+03	0.3335E+03	-60.94
39600.	11.15	230.00	-50.99	0.2119E+03	0.3323E+03	-61.13
39700.	10.50	233.00	-51.24	0.2109E+03	0.3311E+03	-61.32
39800.	11.15	233.00	-51.49	0.2099E+03	0.3299E+03	-61.51
39900.	9.51	227.00	-51.74	0.2090E+03	0.3288E+03	-61.70

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
40000.	9.84	227.00	-51.99	0.2080E+03	0.3276E+03	-61.89
40100.	13.45	225.00	-52.25	0.2070E+03	0.3265E+03	-62.11
40200.	14.76	229.00	-52.51	0.2060E+03	0.3253E+03	-62.33
40300.	14.76	232.00	-52.77	0.2051E+03	0.3242E+03	-62.55
40400.	16.40	228.00	-53.03	0.2041E+03	0.3230E+03	-62.77
40500.	17.72	223.00	-53.29	0.2031E+03	0.3219E+03	-62.99
40600.	16.40	231.00	-53.55	0.2022E+03	0.3207E+03	-63.21
40700.	21.33	216.00	-53.81	0.2012E+03	0.3196E+03	-63.43
40800.	19.03	216.00	-54.07	0.2003E+03	0.3185E+03	-63.65
40900.	16.73	222.00	-54.33	0.1993E+03	0.3173E+03	-63.87
41000.	18.70	218.00	-54.59	0.1984E+03	0.3162E+03	-64.09
41100.	15.42	235.00	-54.81	0.1975E+03	0.3150E+03	-64.28
41200.	15.75	232.00	-55.03	0.1965E+03	0.3139E+03	-64.47
41300.	14.76	227.00	-55.25	0.1956E+03	0.3127E+03	-64.66
41400.	14.11	230.00	-55.47	0.1947E+03	0.3115E+03	-64.85
41500.	15.42	222.00	-55.69	0.1937E+03	0.3104E+03	-65.04
41600.	13.78	215.00	-55.91	0.1928E+03	0.3092E+03	-65.23
41700.	14.44	228.00	-56.13	0.1919E+03	0.3081E+03	-65.42
41800.	16.40	221.00	-56.35	0.1910E+03	0.3069E+03	-65.61
41900.	15.75	213.00	-56.57	0.1901E+03	0.3058E+03	-65.80
42000.	13.45	222.00	-56.79	0.1892E+03	0.3046E+03	-65.99
42100.	14.11	230.00	-56.92	0.1883E+03	0.3033E+03	-66.11
42200.	12.47	227.00	-57.05	0.1874E+03	0.3021E+03	-66.23
42300.	13.45	243.00	-57.18	0.1865E+03	0.3008E+03	-66.35
42400.	15.75	247.00	-57.31	0.1856E+03	0.2995E+03	-66.47
42500.	15.09	239.00	-57.44	0.1847E+03	0.2983E+03	-66.59
42600.	13.78	259.00	-57.57	0.1838E+03	0.2970E+03	-66.71
42700.	14.44	243.00	-57.70	0.1829E+03	0.2958E+03	-66.83
42800.	11.48	243.00	-57.83	0.1820E+03	0.2945E+03	-66.95
42900.	11.81	238.00	-57.96	0.1812E+03	0.2933E+03	-67.07
43000.	12.47	239.00	-58.09	0.1803E+03	0.2921E+03	-67.19
43100.	11.15	215.00	-58.33	0.1794E+03	0.2910E+03	-9999.00
43200.	8.20	217.00	-58.57	0.1786E+03	0.2899E+03	-9999.00
43300.	12.14	226.00	-58.81	0.1777E+03	0.2888E+03	-9999.00
43400.	14.44	212.00	-59.05	0.1769E+03	0.2878E+03	-9999.00
43500.	12.80	221.00	-59.29	0.1760E+03	0.2867E+03	-9999.00
43600.	18.70	222.00	-59.53	0.1752E+03	0.2856E+03	-9999.00
43700.	19.03	221.00	-59.77	0.1743E+03	0.2846E+03	-9999.00
43800.	19.69	228.00	-60.01	0.1735E+03	0.2835E+03	-9999.00
43900.	20.34	232.00	-60.25	0.1726E+03	0.2825E+03	-9999.00
44000.	22.97	226.00	-60.49	0.1718E+03	0.2814E+03	-9999.00
44100.	22.31	228.00	-60.71	0.1710E+03	0.2804E+03	-9999.00
44200.	21.65	236.00	-60.93	0.1701E+03	0.2793E+03	-9999.00
44300.	22.64	234.00	-61.15	0.1693E+03	0.2782E+03	-9999.00
44400.	20.34	229.00	-61.37	0.1685E+03	0.2771E+03	-9999.00
44500.	18.04	237.00	-61.59	0.1676E+03	0.2761E+03	-9999.00
44600.	19.36	240.00	-61.81	0.1668E+03	0.2750E+03	-9999.00
44700.	20.01	232.00	-62.03	0.1660E+03	0.2739E+03	-9999.00
44800.	15.42	245.00	-62.25	0.1652E+03	0.2729E+03	-9999.00
44900.	20.34	244.00	-62.47	0.1644E+03	0.2718E+03	-9999.00

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
45000.	18.04	238.00	-62.69	0.1636E+03	0.2708E+03	-9999.00
45100.	15.42	249.00	-62.95	0.1628E+03	0.2698E+03	-9999.00
45200.	16.73	253.00	-63.21	0.1620E+03	0.2688E+03	-9999.00
45300.	18.04	242.00	-63.47	0.1612E+03	0.2678E+03	-9999.00
45400.	16.73	230.00	-63.73	0.1604E+03	0.2668E+03	-9999.00
45500.	15.09	236.00	-63.99	0.1596E+03	0.2658E+03	-9999.00
45600.	16.08	233.00	-64.25	0.1588E+03	0.2648E+03	-9999.00
45700.	16.40	232.00	-64.51	0.1580E+03	0.2639E+03	-9999.00
45800.	15.75	236.00	-64.77	0.1572E+03	0.2629E+03	-9999.00
45900.	16.08	229.00	-65.03	0.1565E+03	0.2619E+03	-9999.00
46000.	13.78	225.00	-65.29	0.1557E+03	0.2609E+03	-9999.00
46100.	13.45	229.00	-65.50	0.1549E+03	0.2599E+03	-9999.00
46200.	17.06	224.00	-65.71	0.1541E+03	0.2589E+03	-9999.00
46300.	15.09	233.00	-65.92	0.1534E+03	0.2578E+03	-9999.00
46400.	16.73	235.00	-66.13	0.1526E+03	0.2568E+03	-9999.00
46500.	17.06	228.00	-66.34	0.1519E+03	0.2558E+03	-9999.00
46600.	16.08	245.00	-66.55	0.1511E+03	0.2548E+03	-9999.00
46700.	17.06	245.00	-66.76	0.1503E+03	0.2538E+03	-9999.00
46800.	15.75	238.00	-66.97	0.1496E+03	0.2528E+03	-9999.00
46900.	13.12	253.00	-67.18	0.1488E+03	0.2517E+03	-9999.00
47000.	12.80	239.00	-67.39	0.1481E+03	0.2507E+03	-9999.00
47100.	14.44	220.00	-67.56	0.1474E+03	0.2497E+03	-9999.00
47200.	11.48	228.00	-67.73	0.1466E+03	0.2486E+03	-9999.00
47300.	13.12	218.00	-67.90	0.1459E+03	0.2476E+03	-9999.00
47400.	12.47	217.00	-68.07	0.1451E+03	0.2465E+03	-9999.00
47500.	12.80	217.00	-68.24	0.1444E+03	0.2455E+03	-9999.00
47600.	15.75	204.00	-68.41	0.1437E+03	0.2445E+03	-9999.00
47700.	10.83	221.00	-68.58	0.1430E+03	0.2434E+03	-9999.00
47800.	12.47	246.00	-68.75	0.1422E+03	0.2424E+03	-9999.00
47900.	11.48	248.00	-68.92	0.1415E+03	0.2414E+03	-9999.00
48000.	11.15	260.00	-69.09	0.1408E+03	0.2404E+03	-9999.00
48100.	14.11	258.00	-69.22	0.1401E+03	0.2393E+03	-9999.00
48200.	13.45	247.00	-69.35	0.1394E+03	0.2382E+03	-9999.00
48300.	14.44	245.00	-69.48	0.1387E+03	0.2372E+03	-9999.00
48400.	16.40	257.00	-69.61	0.1380E+03	0.2361E+03	-9999.00
48500.	15.75	272.00	-69.74	0.1373E+03	0.2351E+03	-9999.00
48600.	16.40	291.00	-69.87	0.1366E+03	0.2340E+03	-9999.00
48700.	18.37	280.00	-70.00	0.1359E+03	0.2330E+03	-9999.00
48800.	17.39	287.00	-70.13	0.1352E+03	0.2319E+03	-9999.00
48900.	17.39	281.00	-70.26	0.1345E+03	0.2309E+03	-9999.00
49000.	18.70	277.00	-70.39	0.1338E+03	0.2299E+03	-9999.00
49100.	17.72	274.00	-70.42	0.1331E+03	0.2288E+03	-9999.00
49200.	18.37	288.00	-70.45	0.1325E+03	0.2276E+03	-9999.00
49300.	18.04	285.00	-70.48	0.1318E+03	0.2265E+03	-9999.00
49400.	15.09	270.00	-70.51	0.1311E+03	0.2254E+03	-9999.00
49500.	15.75	280.00	-70.54	0.1305E+03	0.2243E+03	-9999.00
49600.	16.08	272.00	-70.57	0.1298E+03	0.2232E+03	-9999.00
49700.	15.09	264.00	-70.60	0.1291E+03	0.2221E+03	-9999.00
49800.	12.80	279.00	-70.63	0.1285E+03	0.2210E+03	-9999.00
49900.	17.39	315.00	-70.66	0.1278E+03	0.2199E+03	-9999.00

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
50000.	16.40	335.00	-70.69	0.1272E+03	0.2189E+03	-9999.00
50100.	14.76	346.00	-70.77	0.1265E+03	0.2178E+03	-9999.00
50200.	16.08	358.00	-70.85	0.1259E+03	0.2168E+03	-9999.00
50300.	13.12	6.00	-70.93	0.1252E+03	0.2158E+03	-9999.00
50400.	10.17	29.00	-71.01	0.1246E+03	0.2147E+03	-9999.00
50500.	9.51	37.00	-71.09	0.1240E+03	0.2137E+03	-9999.00
50600.	8.86	46.00	-71.17	0.1233E+03	0.2127E+03	-9999.00
50700.	11.15	70.00	-71.25	0.1227E+03	0.2117E+03	-9999.00
50800.	12.47	87.00	-71.33	0.1221E+03	0.2107E+03	-9999.00
50900.	14.76	78.00	-71.41	0.1214E+03	0.2097E+03	-9999.00
51000.	17.06	100.00	-71.49	0.1208E+03	0.2087E+03	-9999.00
51100.	21.00	103.00	-71.48	0.1202E+03	0.2076E+03	-9999.00
51200.	23.95	112.00	-71.47	0.1196E+03	0.2065E+03	-9999.00
51300.	29.53	114.00	-71.46	0.1190E+03	0.2055E+03	-9999.00
51400.	28.22	115.00	-71.45	0.1184E+03	0.2044E+03	-9999.00
51500.	30.51	127.00	-71.44	0.1178E+03	0.2034E+03	-9999.00
51600.	28.54	126.00	-71.43	0.1172E+03	0.2023E+03	-9999.00
51700.	26.57	132.00	-71.42	0.1166E+03	0.2013E+03	-9999.00
51800.	25.92	138.00	-71.41	0.1160E+03	0.2003E+03	-9999.00
51900.	25.26	152.00	-71.40	0.1154E+03	0.1992E+03	-9999.00
52000.	21.33	155.00	-71.39	0.1148E+03	0.1982E+03	-9999.00
52100.	23.62	161.00	-71.45	0.1142E+03	0.1973E+03	-9999.00
52200.	24.61	165.00	-71.51	0.1136E+03	0.1963E+03	-9999.00
52300.	23.62	162.00	-71.57	0.1131E+03	0.1954E+03	-9999.00
52400.	25.26	165.00	-71.63	0.1125E+03	0.1945E+03	-9999.00
52500.	22.64	159.00	-71.69	0.1119E+03	0.1935E+03	-9999.00
52600.	20.01	160.00	-71.75	0.1113E+03	0.1926E+03	-9999.00
52700.	19.69	161.00	-71.81	0.1108E+03	0.1917E+03	-9999.00
52800.	18.70	159.00	-71.87	0.1102E+03	0.1908E+03	-9999.00
52900.	22.31	158.00	-71.93	0.1097E+03	0.1898E+03	-9999.00
53000.	20.67	154.00	-71.99	0.1091E+03	0.1889E+03	-9999.00
53100.	22.97	146.00	-71.88	0.1085E+03	0.1879E+03	-9999.00
53200.	22.64	139.00	-71.77	0.1080E+03	0.1868E+03	-9999.00
53300.	28.22	136.00	-71.66	0.1074E+03	0.1857E+03	-9999.00
53400.	33.14	139.00	-71.55	0.1069E+03	0.1847E+03	-9999.00
53500.	27.89	145.00	-71.44	0.1063E+03	0.1836E+03	-9999.00
53600.	28.22	146.00	-71.33	0.1058E+03	0.1826E+03	-9999.00
53700.	26.25	153.00	-71.22	0.1052E+03	0.1815E+03	-9999.00
53800.	30.18	153.00	-71.11	0.1047E+03	0.1805E+03	-9999.00
53900.	30.51	147.00	-71.00	0.1041E+03	0.1795E+03	-9999.00
54000.	30.18	143.00	-70.89	0.1036E+03	0.1784E+03	-9999.00
54100.	31.82	138.00	-70.75	0.1031E+03	0.1774E+03	-9999.00
54200.	30.84	143.00	-70.61	0.1025E+03	0.1764E+03	-9999.00
54300.	30.84	151.00	-70.47	0.1020E+03	0.1754E+03	-9999.00
54400.	27.23	157.00	-70.33	0.1015E+03	0.1744E+03	-9999.00
54500.	24.93	157.00	-70.19	0.1010E+03	0.1733E+03	-9999.00
54600.	21.33	157.00	-70.05	0.1005E+03	0.1723E+03	-9999.00
54700.	17.06	155.00	-69.91	0.9997E+02	0.1714E+03	-9999.00
54800.	14.11	147.00	-69.77	0.9946E+02	0.1704E+03	-9999.00
54900.	13.78	133.00	-69.63	0.9895E+02	0.1694E+03	-9999.00

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
55000.	12.47	118.00	-69.49	0.9845E+02	0.1684E+03	-9999.00
55100.	15.75	133.00	-69.39	0.9795E+02	0.1675E+03	-9999.00
55200.	16.73	125.00	-69.29	0.9746E+02	0.1665E+03	-9999.00
55300.	20.34	130.00	-69.19	0.9697E+02	0.1656E+03	-9999.00
55400.	19.36	115.00	-69.09	0.9648E+02	0.1647E+03	-9999.00
55500.	21.00	120.00	-68.99	0.9599E+02	0.1638E+03	-9999.00
55600.	14.11	123.00	-68.89	0.9550E+02	0.1629E+03	-9999.00
55700.	12.47	137.00	-68.79	0.9502E+02	0.1620E+03	-9999.00
55800.	6.89	110.00	-68.69	0.9454E+02	0.1611E+03	-9999.00
55900.	8.20	73.00	-68.59	0.9406E+02	0.1602E+03	-9999.00
56000.	10.17	96.00	-68.49	0.9359E+02	0.1593E+03	-9999.00
56500.	10.23	133.00	-68.29	0.9126E+02	0.1552E+03	-9999.00
57000.	12.84	102.00	-68.09	0.8898E+02	0.1512E+03	-9999.00
57500.	14.44	92.00	-67.49	0.8677E+02	0.1470E+03	-9999.00
58000.	18.37	87.00	-67.49	0.8462E+02	0.1433E+03	-9999.00
58500.	21.65	84.00	-67.69	0.8252E+02	0.1399E+03	-9999.00
59000.	25.26	83.00	-67.89	0.8047E+02	0.1366E+03	-9999.00
59500.	29.53	85.00	-67.89	0.7847E+02	0.1332E+03	-9999.00
60000.	36.09	91.00	-67.69	0.7652E+02	0.1297E+03	-9999.00
60500.	42.98	98.00	-67.29	0.7462E+02	0.1263E+03	-9999.00
61000.	48.88	106.00	-66.99	0.7277E+02	0.1230E+03	-9999.00
61500.	50.20	109.00	-66.09	0.7098E+02	0.1194E+03	-9999.00
62000.	49.21	110.00	-64.49	0.6923E+02	0.1156E+03	-9999.00
62500.	46.26	108.00	-62.49	0.6755E+02	0.1117E+03	-9999.00
63000.	43.96	104.00	-61.49	0.6591E+02	0.1085E+03	-9999.00
63500.	43.31	99.00	-61.99	0.6432E+02	0.1061E+03	-9999.00
64000.	44.29	98.00	-62.09	0.6277E+02	0.1036E+03	-9999.00
64500.	45.60	99.00	-61.99	0.6125E+02	0.1010E+03	-9999.00
65000.	45.93	100.00	-61.59	0.5977E+02	0.9842E+02	-9999.00
65500.	44.95	100.00	-60.59	0.5833E+02	0.9560E+02	-9999.00
66000.	44.62	98.00	-59.29	0.5694E+02	0.9275E+02	-9999.00
66500.	45.60	96.00	-58.69	0.5558E+02	0.9028E+02	-9999.00
67000.	47.57	97.00	-59.09	0.5426E+02	0.8830E+02	-9999.00
67500.	50.52	99.00	-59.49	0.5296E+02	0.8635E+02	-9999.00
68000.	53.48	103.00	-58.59	0.5170E+02	0.8394E+02	-9999.00
68500.	55.45	109.00	-57.69	0.5048E+02	0.8162E+02	-9999.00
69000.	55.77	114.00	-56.99	0.4928E+02	0.7942E+02	-9999.00
69500.	55.12	119.00	-55.29	0.4813E+02	0.7696E+02	-9999.00
70000.	53.48	122.00	-53.49	0.4700E+02	0.7454E+02	-9999.00
70500.	51.18	123.00	-52.49	0.4591E+02	0.7248E+02	-9999.00
71000.	49.54	122.00	-51.69	0.4486E+02	0.7057E+02	-9999.00
71500.	48.23	121.00	-50.89	0.4382E+02	0.6868E+02	-9999.00
72000.	46.92	120.00	-50.49	0.4282E+02	0.6700E+02	-9999.00
72500.	45.28	119.00	-50.99	0.4184E+02	0.6561E+02	-9999.00
73000.	44.62	116.00	-51.19	0.4088E+02	0.6416E+02	-9999.00
73500.	43.96	111.00	-50.69	0.3994E+02	0.6255E+02	-9999.00
74000.	43.64	103.00	-51.09	0.3902E+02	0.6121E+02	-9999.00
74500.	42.98	96.00	-51.29	0.3812E+02	0.5986E+02	-9999.00
75000.	41.67	91.00	-51.69	0.3725E+02	0.5860E+02	-9999.00
75500.	41.34	87.00	-51.49	0.3639E+02	0.5719E+02	-9999.00

TABLE 5. (Continued)

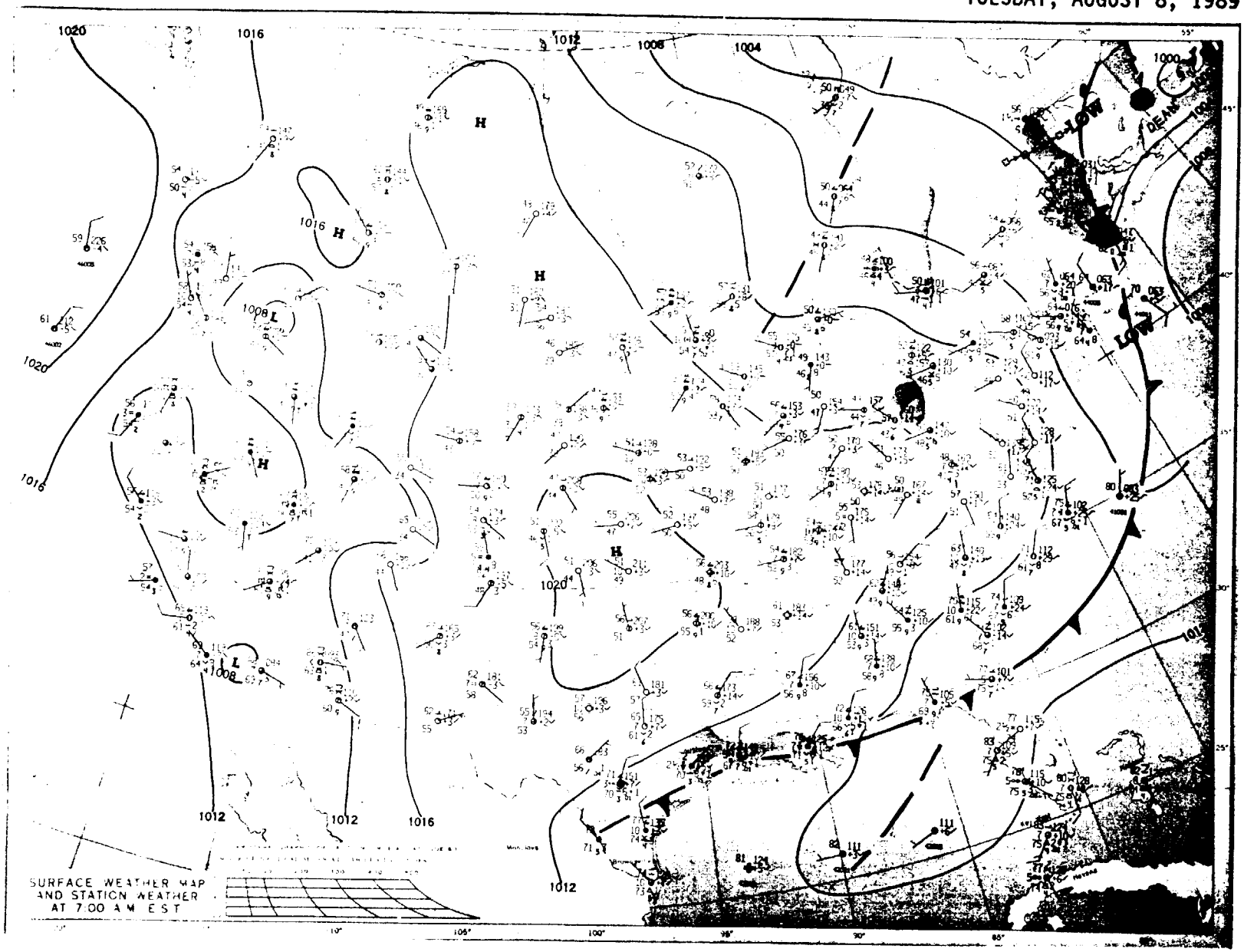
ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
76000.	41.34	84.00	-51.19	0.3555E+02	0.5580E+02	-9999.00
76500.	40.35	81.00	-50.39	0.3474E+02	0.5433E+02	-9999.00
77000.	39.04	81.00	-50.59	0.3394E+02	0.5313E+02	-9999.00
77500.	40.03	81.00	-50.69	0.3317E+02	0.5194E+02	-9999.00
78000.	41.34	81.00	-50.59	0.3241E+02	0.5073E+02	-9999.00
78500.	43.31	84.00	-50.29	0.3166E+02	0.4949E+02	-9999.00
79000.	45.28	84.00	-49.39	0.3094E+02	0.4817E+02	-9999.00
79500.	47.90	81.00	-49.29	0.3024E+02	0.4706E+02	-9999.00
80000.	50.20	78.00	-49.49	0.2955E+02	0.4603E+02	-9999.00
80500.	51.84	76.00	-49.49	0.2887E+02	0.4497E+02	-9999.00
81000.	53.48	75.00	-49.59	0.2822E+02	0.4397E+02	-9999.00
81500.	54.79	75.00	-49.79	0.2757E+02	0.4300E+02	-9999.00
82000.	55.45	78.00	-50.09	0.2694E+02	0.4207E+02	-9999.00
82500.	56.10	81.00	-50.19	0.2633E+02	0.4114E+02	-9999.00
83000.	56.76	83.00	-49.99	0.2573E+02	0.4017E+02	-9999.00
83500.	56.76	84.00	-49.79	0.2514E+02	0.3921E+02	-9999.00
84000.	57.41	86.00	-49.39	0.2457E+02	0.3825E+02	-9999.00
84500.	59.06	86.00	-48.89	0.2401E+02	0.3730E+02	-9999.00
85000.	60.70	87.00	-48.69	0.2346E+02	0.3641E+02	-9999.00
85500.	62.34	87.00	-49.09	0.2293E+02	0.3565E+02	-9999.00
86000.	64.63	88.00	-49.39	0.2241E+02	0.3489E+02	-9999.00
86500.	67.59	89.00	-49.49	0.2190E+02	0.3411E+02	-9999.00
87000.	70.54	90.00	-49.59	0.2140E+02	0.3335E+02	-9999.00
87500.	73.16	91.00	-48.99	0.2091E+02	0.3250E+02	-9999.00
88000.	76.44	93.00	-47.59	0.2044E+02	0.3157E+02	-9999.00
88500.	79.40	95.00	-46.69	0.1998E+02	0.3074E+02	-9999.00
89000.	81.69	96.00	-44.99	0.1953E+02	0.2982E+02	-9999.00
89500.	83.01	96.00	-43.29	0.1909E+02	0.2893E+02	-9999.00
90000.	81.69	96.00	-43.09	0.1867E+02	0.2827E+02	-9999.00
90500.	79.40	94.00	-42.89	0.1826E+02	0.2763E+02	-9999.00
91000.	76.77	92.00	-43.09	0.1785E+02	0.2703E+02	-9999.00
91500.	74.80	91.00	-42.59	0.1746E+02	0.2638E+02	-9999.00
92000.	73.82	91.00	-42.19	0.1707E+02	0.2575E+02	-9999.00
94000.	72.95	90.16	-41.02	0.1510E+02	0.2267E+02	-9999.00
97000.	71.67	88.86	-39.26	0.1257E+02	0.1873E+02	-9999.00
100000.	70.43	87.52	-37.51	0.1046E+02	0.1547E+02	-9999.00
103000.	69.23	86.13	-35.75	0.8710E+01	0.1278E+02	-9999.00
106000.	68.07	84.69	-34.00	0.7250E+01	0.1056E+02	-9999.00
109000.	69.10	84.39	-32.07	0.6380E+01	0.9219E+01	-9999.00
112000.	70.42	84.60	-30.02	0.5630E+01	0.8067E+01	-9999.00
115000.	72.07	85.20	-27.86	0.4980E+01	0.7073E+01	-9999.00
118000.	73.69	85.76	-25.71	0.4410E+01	0.6209E+01	-9999.00
121000.	75.32	86.30	-23.56	0.3900E+01	0.5443E+01	-9999.00
124000.	76.99	86.82	-21.40	0.3450E+01	0.4774E+01	-9999.00
127000.	78.63	87.32	-19.25	0.3050E+01	0.4185E+01	-9999.00
130000.	81.28	87.55	-16.95	0.2720E+01	0.3699E+01	-9999.00
133000.	83.92	87.76	-14.65	0.2420E+01	0.3261E+01	-9999.00
136000.	86.57	87.96	-12.36	0.2160E+01	0.2885E+01	-9999.00
139000.	89.19	88.14	-10.06	0.1920E+01	0.2542E+01	-9999.00
142000.	91.84	88.30	-7.77	0.1710E+01	0.2245E+01	-9999.00

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
145000.	92.01	89.00	-6.21	0.1530E+01	0.1997E+01	-9999.00
148000.	89.04	90.38	-5.56	0.1370E+01	0.1784E+01	-9999.00
151000.	86.17	91.85	-4.91	0.1220E+01	0.1584E+01	-9999.00
154000.	83.32	93.43	-4.27	0.1100E+01	0.1425E+01	-9999.00
157000.	80.57	95.14	-3.62	0.9800E+00	0.1267E+01	-9999.00
160000.	77.87	96.95	-2.98	0.8760E+00	0.1130E+01	-9999.00
163000.	75.99	97.57	-4.04	0.7840E+00	0.1015E+01	-9999.00
166000.	74.19	98.06	-5.31	0.7010E+00	0.9118E+00	-9999.00
169000.	72.40	98.57	-6.60	0.6260E+00	0.8182E+00	-9999.00
172000.	70.61	99.12	-7.89	0.5590E+00	0.7341E+00	-9999.00
175000.	68.83	99.69	-9.18	0.4990E+00	0.6585E+00	-9999.00
178000.	67.55	100.55	-10.88	0.4450E+00	0.5911E+00	-9999.00
181000.	67.19	102.03	-13.43	0.3960E+00	0.5312E+00	-9999.00
184000.	66.91	103.53	-15.96	0.3520E+00	0.4768E+00	-9999.00
187000.	66.65	105.03	-18.50	0.3130E+00	0.4282E+00	-9999.00
190000.	66.47	106.55	-21.04	0.2780E+00	0.3841E+00	-9999.00
193000.	66.30	108.08	-23.57	0.2470E+00	0.3448E+00	-9999.00
196000.	64.15	107.56	-26.80	0.2190E+00	0.3097E+00	-9999.00
199000.	61.43	106.41	-30.23	0.1930E+00	0.2768E+00	-9999.00
202000.	58.74	105.15	-33.66	0.1700E+00	0.2473E+00	-9999.00
205000.	56.08	103.78	-37.09	0.1500E+00	0.2214E+00	-9999.00
208000.	53.45	102.26	-40.53	0.1320E+00	0.1977E+00	-9999.00
211000.	50.42	100.12	-43.90	0.1160E+00	0.1763E+00	-9999.00
214000.	45.87	95.83	-47.01	0.1020E+00	0.1571E+00	-9999.00
217000.	41.67	90.59	-50.13	0.8870E-01	0.1386E+00	-9999.00
220000.	37.85	84.28	-53.25	0.7740E-01	0.1226E+00	-9999.00
223000.	34.62	76.69	-56.48	0.6760E-01	0.1087E+00	-9999.00
226000.	32.09	67.71	-59.71	0.5890E-01	0.9613E-01	-9999.00
229000.	33.37	63.23	-61.89	0.5110E-01	0.8426E-01	-9999.00
232000.	36.21	61.72	-63.54	0.4420E-01	0.7346E-01	-9999.00
235000.	39.10	60.38	-65.19	0.3820E-01	0.6399E-01	-9999.00
238000.	42.03	59.25	-66.83	0.3310E-01	0.5589E-01	-9999.00
241000.	44.93	58.28	-68.48	0.2860E-01	0.4868E-01	-9999.00
244000.	47.17	56.95	-70.08	0.2470E-01	0.4237E-01	-9999.00
247000.	43.99	51.75	-71.31	0.2130E-01	0.3676E-01	-9999.00
250000.	41.23	45.74	-72.59	0.1830E-01	0.3179E-01	-9999.00
253000.	39.00	38.99	-73.87	0.1580E-01	0.2762E-01	-9999.00
256000.	37.36	31.50	-75.15	0.1360E-01	0.2393E-01	-9999.00
259000.	36.42	23.52	-76.43	0.1170E-01	0.2072E-01	-9999.00
262000.	34.27	19.75	-77.77	0.1000E-01	0.1783E-01	-9999.00
265000.	30.72	19.60	-79.18	0.8570E-02	0.1539E-01	-9999.00
268000.	27.17	19.40	-80.58	0.7340E-02	0.1328E-01	-9999.00
271000.	23.62	19.14	-81.98	0.6280E-02	0.1144E-01	-9999.00
274000.	20.07	18.79	-83.38	0.5380E-02	0.9876E-02	-9999.00
277000.	16.52	18.29	-84.83	0.4600E-02	0.8509E-02	-9999.00
280000.	14.71	344.48	-85.21	0.3920E-02	0.7266E-02	-9999.00
283000.	18.17	314.20	-85.59	0.3340E-02	0.6204E-02	-9999.00
286000.	24.77	296.77	-85.97	0.2850E-02	0.5304E-02	-9999.00
289000.	32.69	287.16	-86.35	0.2430E-02	0.4532E-02	-9999.00
292000.	41.14	281.45	-86.73	0.2070E-02	0.3868E-02	-9999.00

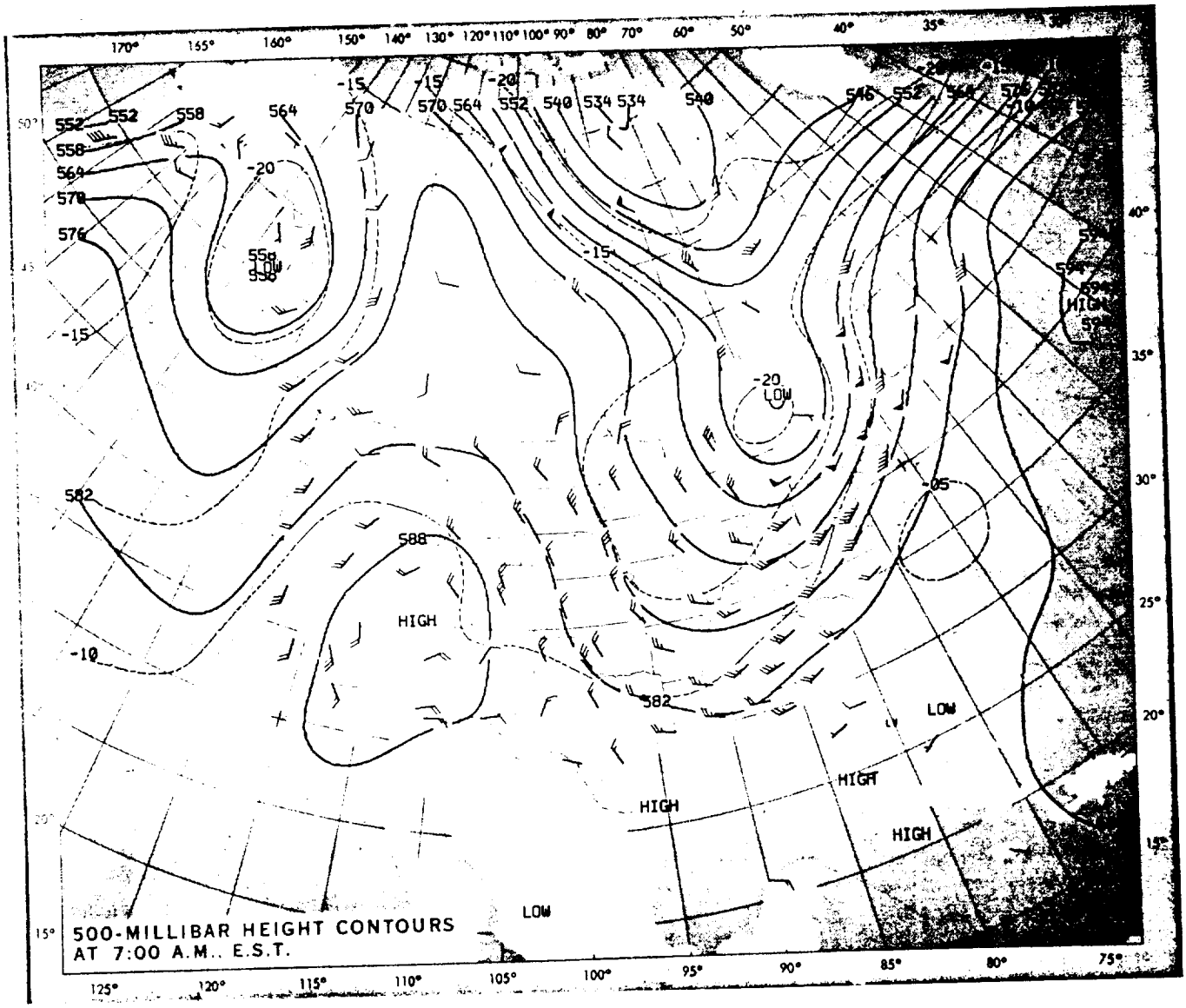
TABLE 5. (Concluded)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
295000.	69.53	275.63	-86.30	0.1770E-02	0.3300E-02	-9999.00
298000.	126.93	272.59	-84.86	0.1510E-02	0.2794E-02	-9999.00
301000.	187.43	271.42	-83.41	0.1290E-02	0.2368E-02	-9999.00
304000.	246.25	270.83	-81.97	0.1100E-02	0.2004E-02	-9999.00
307000.	296.24	270.47	-80.53	0.9410E-03	0.1702E-02	-9999.00
310000.	326.91	270.22	-79.08	0.8040E-03	0.1443E-02	-9999.00
313000.	341.47	270.18	-77.62	0.6910E-03	0.1231E-02	-9999.00
316000.	351.38	270.17	-76.15	0.5940E-03	0.1050E-02	-9999.00
319000.	354.17	270.15	-74.69	0.5100E-03	0.8952E-03	-9999.00
322000.	347.08	270.13	-73.22	0.4390E-03	0.7649E-03	-9999.00
325000.	326.57	270.09	-71.75	0.3770E-03	0.6521E-03	-9999.00
328000.	306.99	270.09	-69.66	0.3250E-03	0.5564E-03	-9999.00
331000.	314.76	270.02	-66.31	0.2810E-03	0.4733E-03	-9999.00
334000.	315.55	269.92	-62.96	0.2430E-03	0.4027E-03	-9999.00
337000.	306.63	269.77	-59.61	0.2100E-03	0.3426E-03	-9999.00
340000.	284.52	269.55	-56.26	0.1820E-03	0.2923E-03	-9999.00
343000.	244.81	269.17	-52.91	0.1570E-03	0.2483E-03	-9999.00
346000.	235.15	269.35	-46.88	0.1380E-03	0.2125E-03	-9999.00
349000.	232.85	268.93	-40.09	0.1220E-03	0.1824E-03	-9999.00
352000.	223.00	268.31	-33.29	0.1080E-03	0.1569E-03	-9999.00
355000.	203.14	267.33	-26.49	0.9490E-04	0.1340E-03	-9999.00
358000.	170.25	265.60	-19.70	0.8360E-04	0.1149E-03	-9999.00
361000.	131.97	266.28	-12.27	0.7410E-04	0.9895E-04	-9999.00
364000.	127.14	264.60	-2.63	0.6720E-04	0.8654E-04	-9999.00
367000.	118.25	262.11	7.01	0.6080E-04	0.7560E-04	-9999.00
370000.	104.43	258.14	16.65	0.5500E-04	0.6612E-04	-9999.00
373000.	85.05	250.86	26.29	0.4970E-04	0.5782E-04	-9999.00
376000.	61.33	234.41	35.92	0.4490E-04	0.5061E-04	-9999.00
379000.	41.20	240.78	46.36	0.4090E-04	0.4459E-04	-9999.00
382000.	40.39	236.36	57.48	0.3760E-04	0.3962E-04	-9999.00
385000.	39.96	231.63	68.90	0.3470E-04	0.3534E-04	-9999.00
388000.	39.87	226.60	80.62	0.3210E-04	0.3161E-04	-9999.00
391000.	40.12	221.42	92.60	0.2970E-04	0.2829E-04	-9999.00
394000.	40.78	216.13	104.82	0.2770E-04	0.2553E-04	-9999.00
397000.	41.86	210.89	117.23	0.2580E-04	0.2302E-04	-9999.00
400000.	43.32	205.77	129.82	0.2410E-04	0.2083E-04	-9999.00



Surface Synoptic Map at 1200 u.t. August 8, 1989 — Isobaric, Frontal, and Precipitation Patterns Are Shown in Standard Symbolic Form.

Figure 1. Surface synoptic chart 37 min before launch of STS-28.



500 Millibar Height
Contours at 1200 u.t.
August 8, 1989.
Continuous Lines Indicate Height Contours in Feet Above Sea Level.
Dashed Lines Are Isotherms in Degrees Centigrade. Arrows Show Wind
Direction and Speed at the 500-mb Level.

Figure 2. 500-mb map 37 min before launch of STS-28.

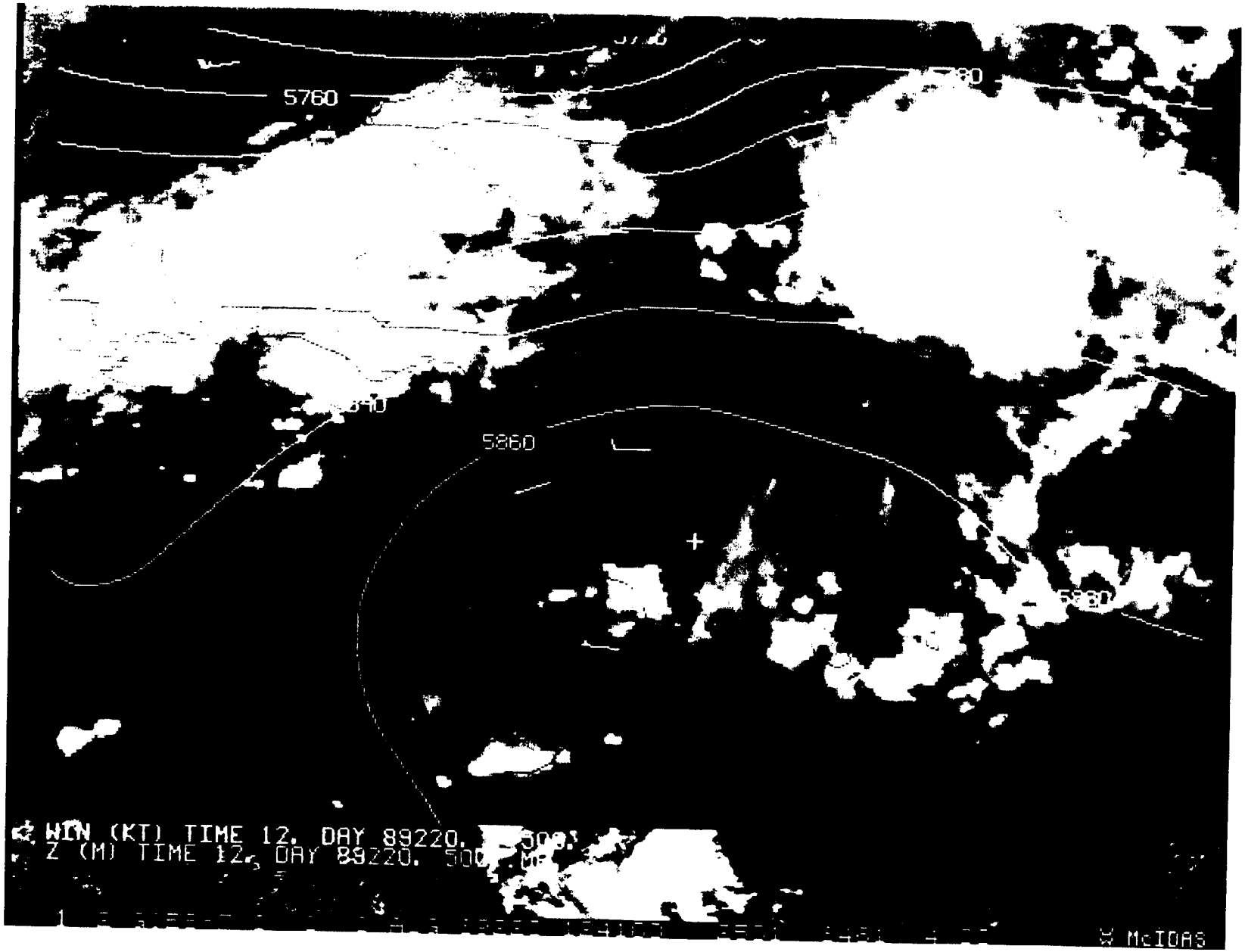


Figure 3. GOES-7 infrared imagery of cloud cover 4 min after launch of STS-28 (1237 u.t., August 8, 1989). 500-mb heights (meters) and wind barbs are also included for 1200 u.t.

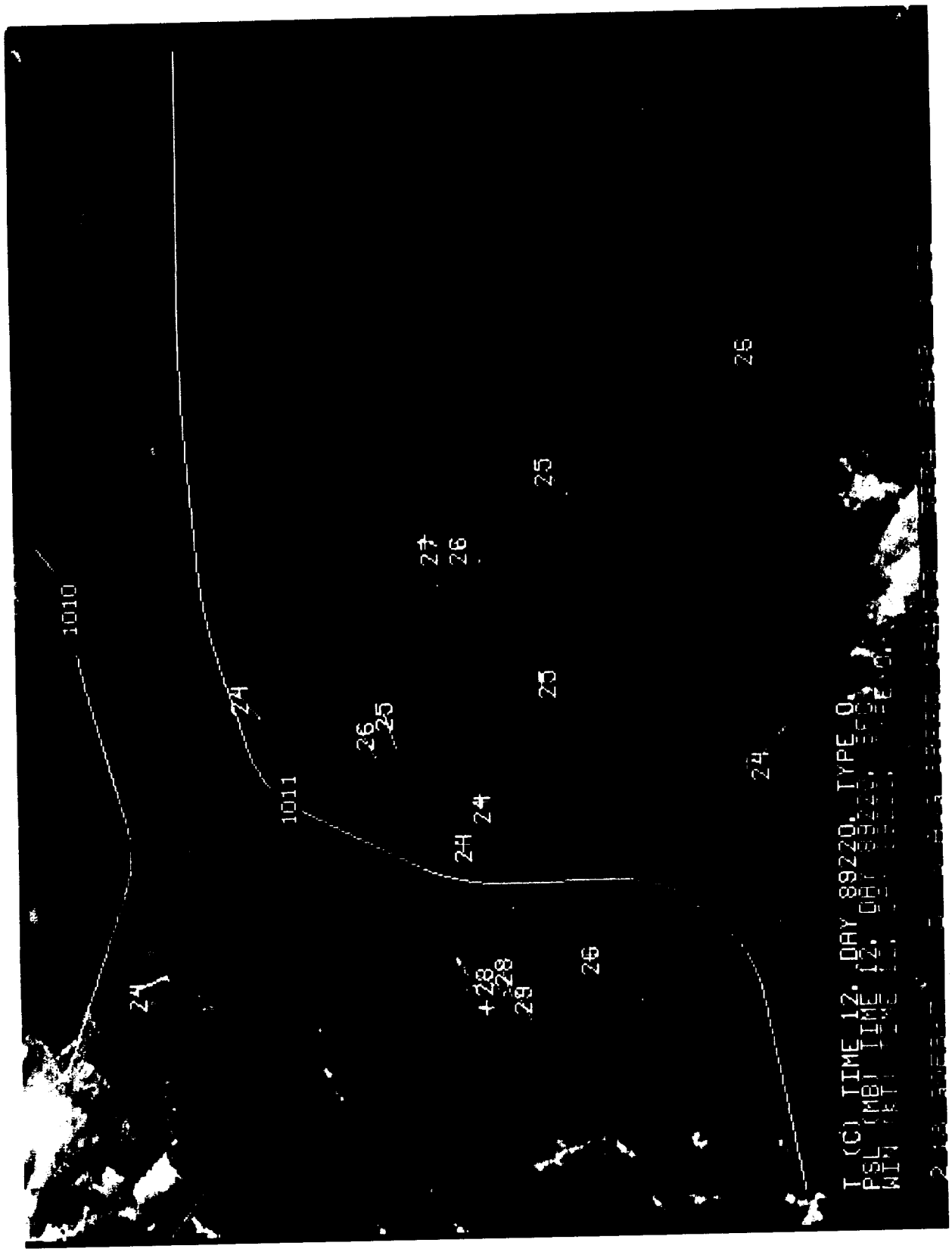


Figure 4. Enlarged view of GOES-7 visible imagery of cloud cover taken 4 min after launch of STS-28 (1241 u.t., August 8, 1989). Surface temperatures, isobaric parameters, and wind barbs for 1200 u.t. are also included.

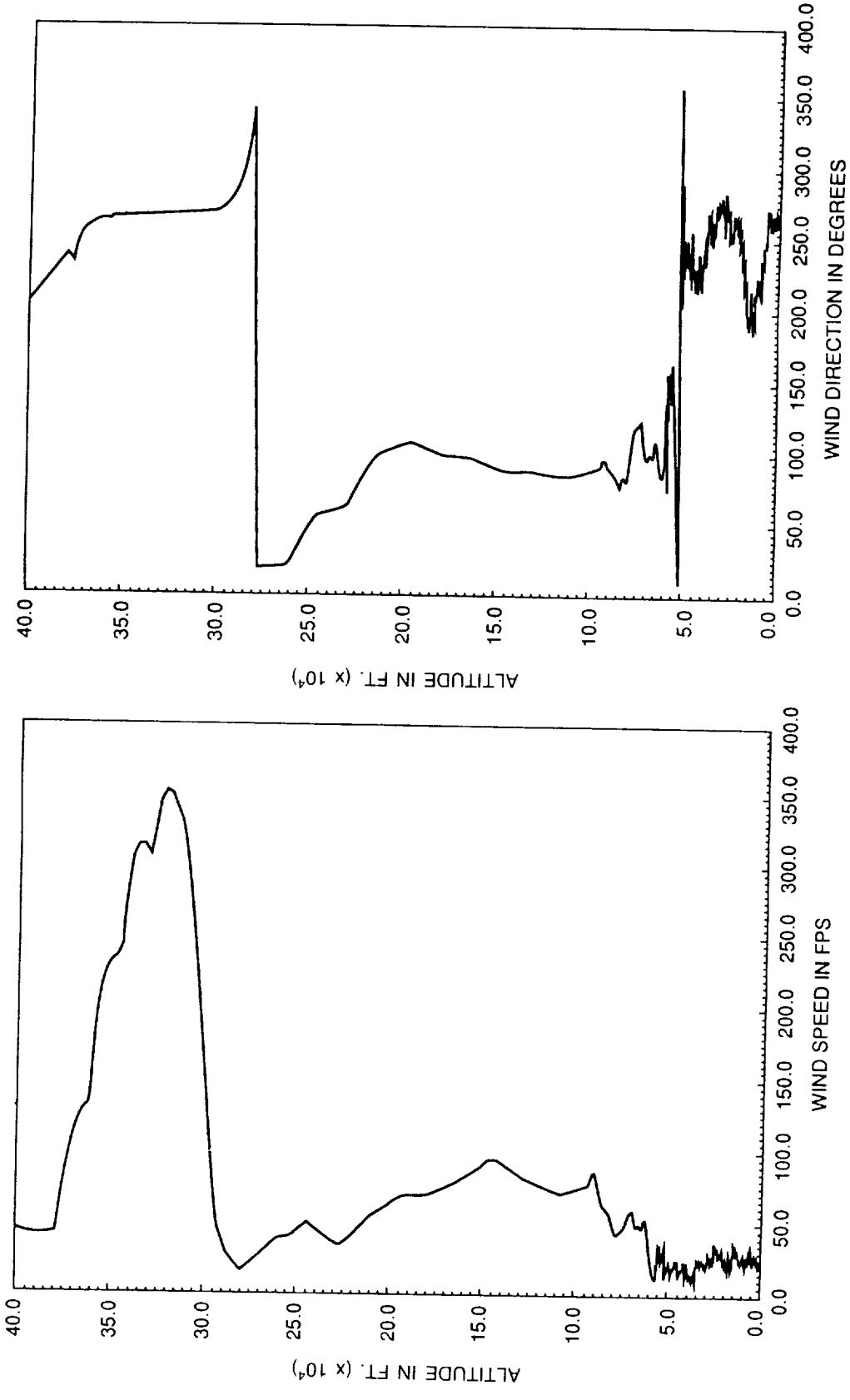


Figure 5. Scalar wind speed and direction at launch time of STS-28.

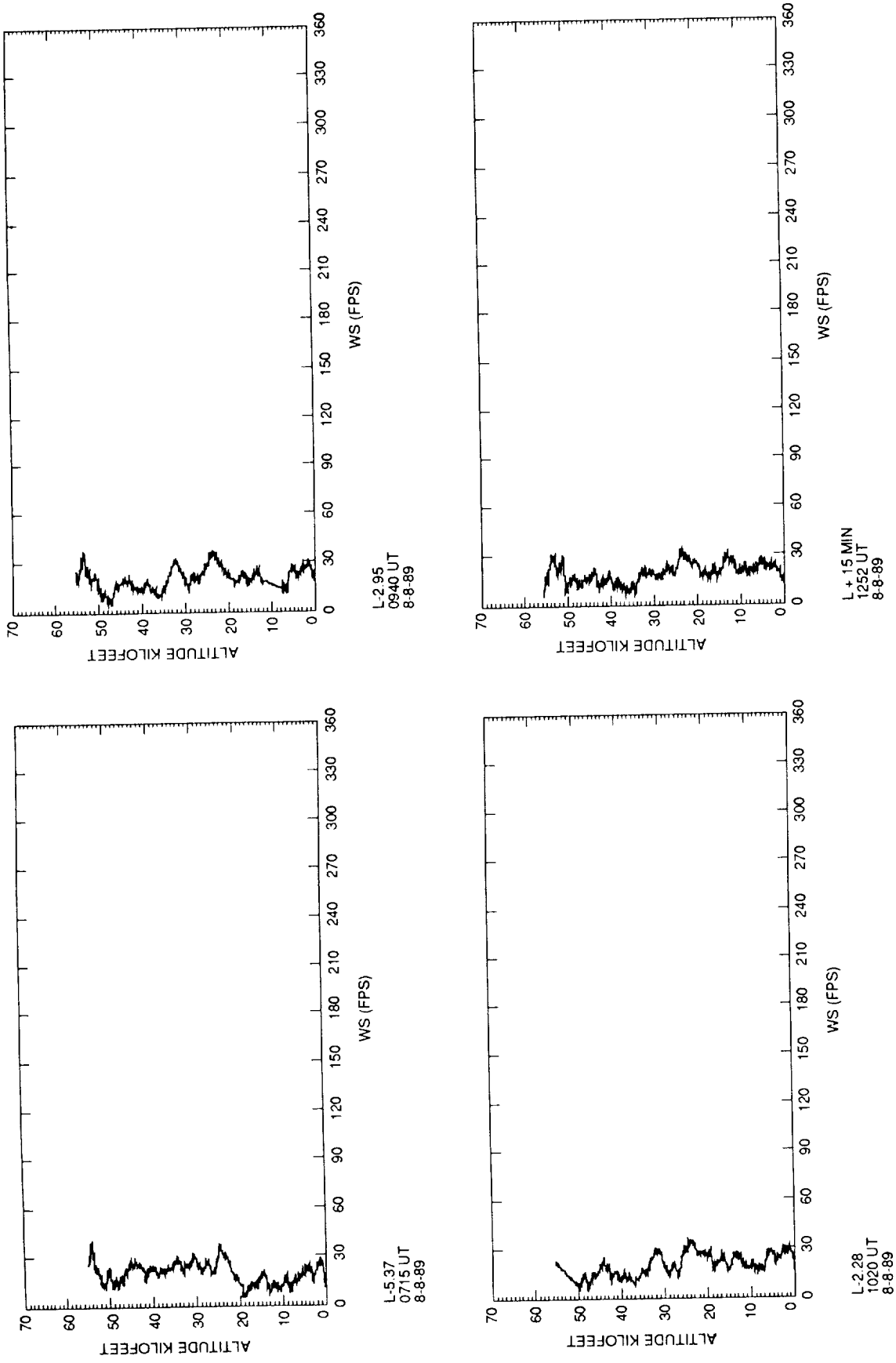


Figure 6. STS-28 prelaunch/launch Jimsphere-measured wind speeds (FPS).

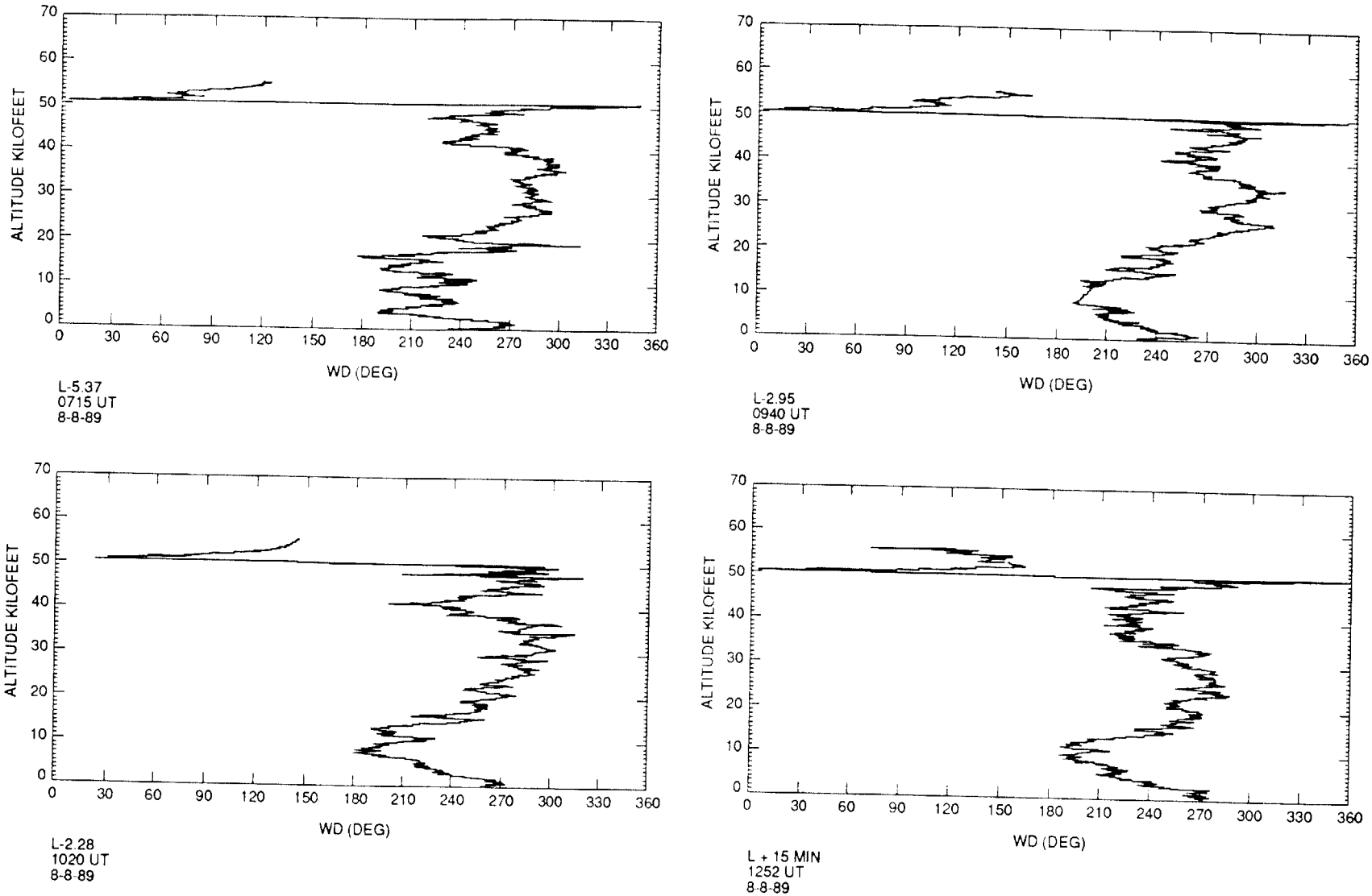


Figure 7. STS-28 prelaunch/launch Jimsphere-measured wind directions (degrees).

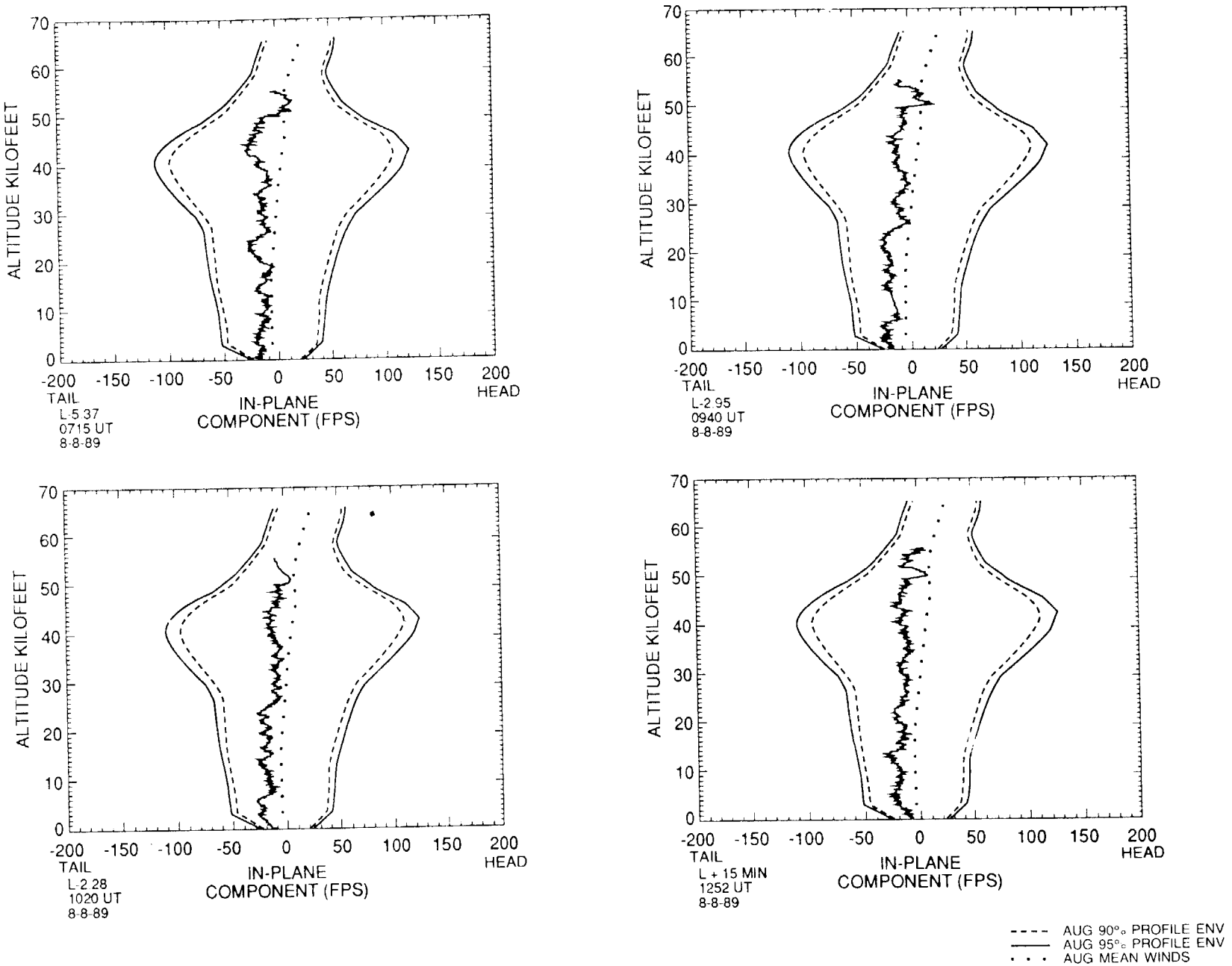


Figure 8. STS-28 prelaunch/launch Jimsphere-measured in-plane component winds (FPS). Reference flight azimuth = 39 deg.

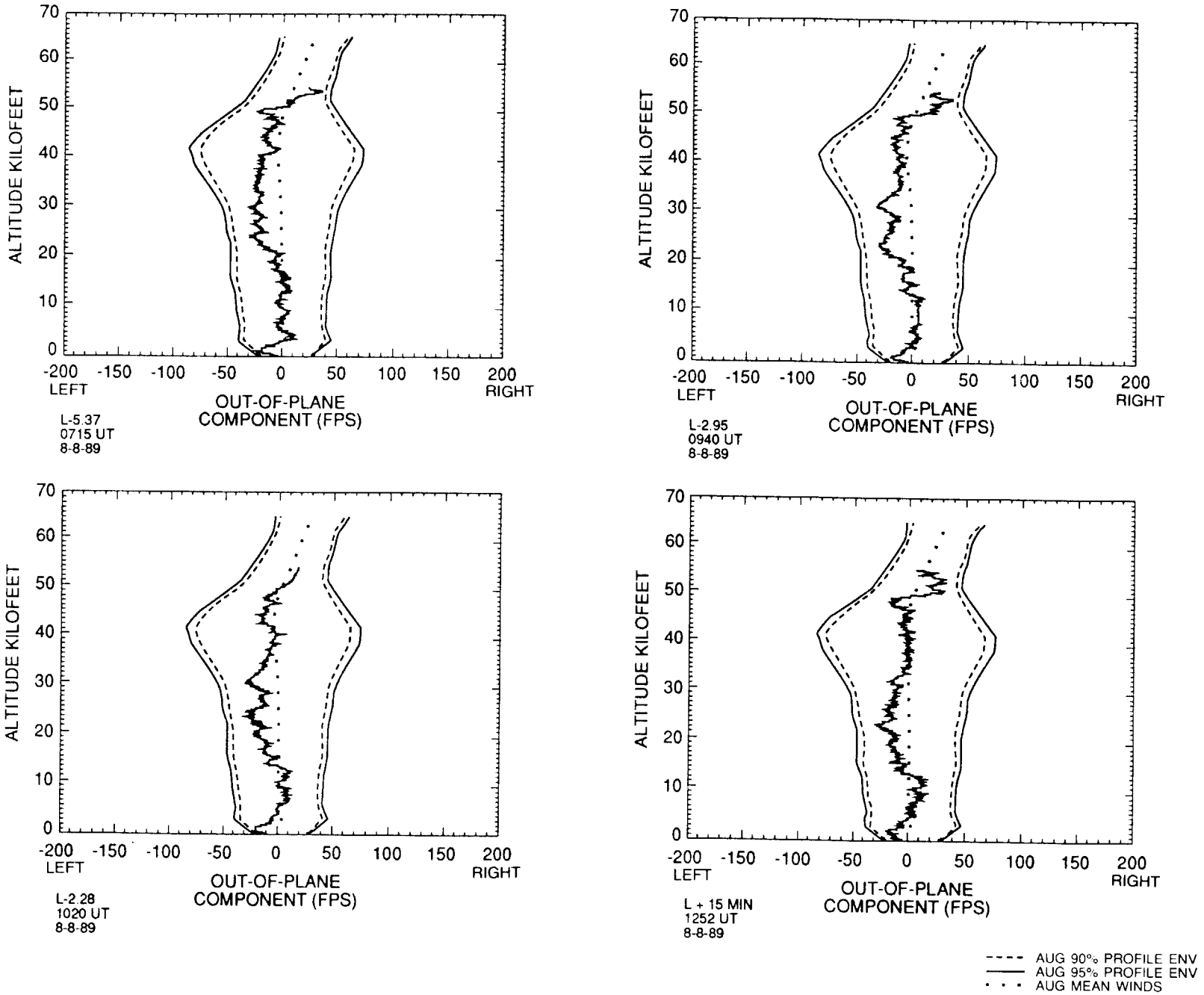


Figure 9. STS-28 prelaunch/launch Jimsphere-measured out-of-plane component winds (FPS). Reference flight azimuth = 39 deg.

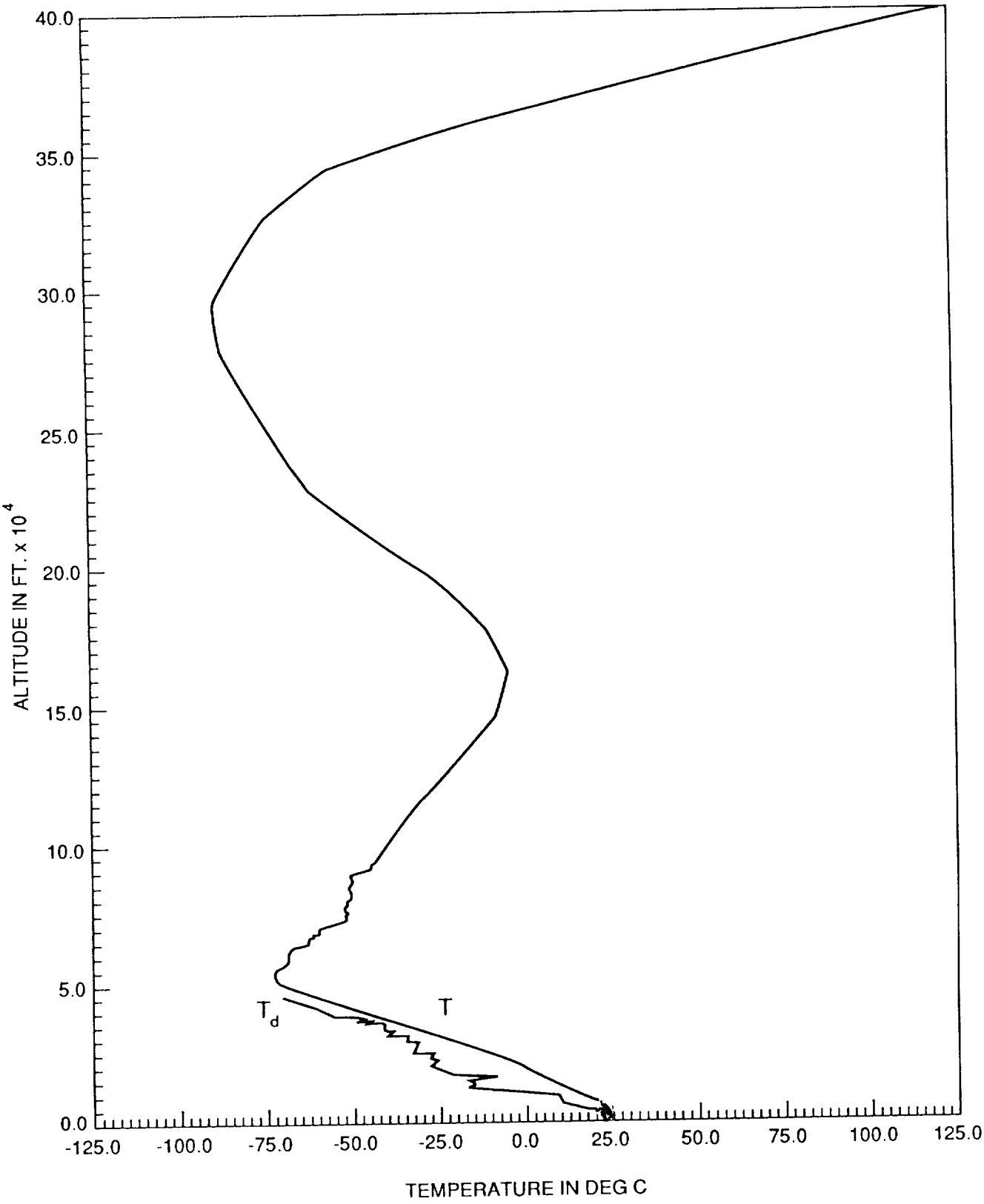


Figure 10. STS-28 temperature profiles versus altitude for launch (ascent).

REFERENCES

1. Saturn Flight Evaluation Working Group: Saturn Launch Vehicle Flight Evaluation Report – Appendix A – Atmosphere (A separate report is prepared for each Saturn vehicle launch operation). George C. Marshall Space Flight Center, Alabama.

2. Johnson, D.L.: Summary of Atmospheric Data Observations for 155 Flights of MSFC/ABMA Related Aerospace Vehicles. NASA TM X-64796, December 5, 1973.

3. Johnson, D.L.: Atmospheric Environment for ASTP (SA-210) Launch. NASA TM X-64990, February 1976.

4. Johnson, D.L., Jasper, G., and Brown, S.C.: Atmospheric Environment for Space Shuttle (STS-1) Launch. NASA TM 82436, July 1981.

5. Johnson, D.L. and Brown, S.C.: Atmospheric Environment for Space Shuttle (STS-2) Launch. NASA TM 82463, December 1981.

6. Johnson, D.L., Brown, S.C., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-3) Launch. NASA TM 82480, April 1982.

7. Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-4) Launch. NASA TM 82498, July 1982.

8. Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-5) Launch. NASA TM 82515, March 1983.

9. Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-6) Launch. NASA TM 82529, May 1983.

10. Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-7) Launch. NASA TM 82542, July 1983.

11. Johnson, D.L., Hill, C.K., Turner, R.E., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-8) Launch. NASA TM 82560, October 1983.

12. Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-9) Launch. NASA TM 82572, January 1984.

13. Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-11) Launch. NASA TM 82580, March 1984.

14. Johnson, D.L., Hill, C.K., Jasper, G., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-13) Launch. NASA TM 82588, May 1984.

15. Johnson, D.L., Hill, C.K., Jasper, G., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-41D) Launch. NASA TM 86484, October 1984.

16. Johnson, D.L., Hill, C.K., Jasper, G., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-41G) Launch. NASA TM 86486, November 1984.

17. Johnson, D.L., Jasper, G., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-51A) Launch. NASA TM 84697, December 1984.

18. Jasper, G.L., Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-51C) Launch. NASA TM 86508, April 1985.

19. Jasper, G.L., Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-51D) Launch. NASA TM 86524, June 1985.

20. Jasper, G.L., Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-51B) Launch. NASA TM 86525, July 1985.

21. Jasper, G.L., Johnson, D.L., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-51L) Launch. NASA TM 86577, December 1986.

22. Jasper, G.L., Johnson, D.L., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-26) Launch. NASA TM 100359, March 1989.

23. Jasper, G.L., Johnson, D.L., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-27) Launch. NASA TM 100370, July 1989.

24. Jasper, G.L. and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-29) Launch. NASA TM 100376, July 1989.

25. Jasper, G.L. and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-30) Launch. NASA 100381, July 1989.

26. Justus, C.G., et al.: The NASA/MSFC Global Reference Atmosphere Model – Mod 3 (with Spherical Harmonic Wind Model). NASA CR-3256, March 1980.

APPROVAL

ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE (STS-28) LAUNCH

By G.L. Jasper and G.W. Batts

The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or nuclear energy activities or programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

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Director, Space Science Laboratory

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